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ELECTRICAL TIMES

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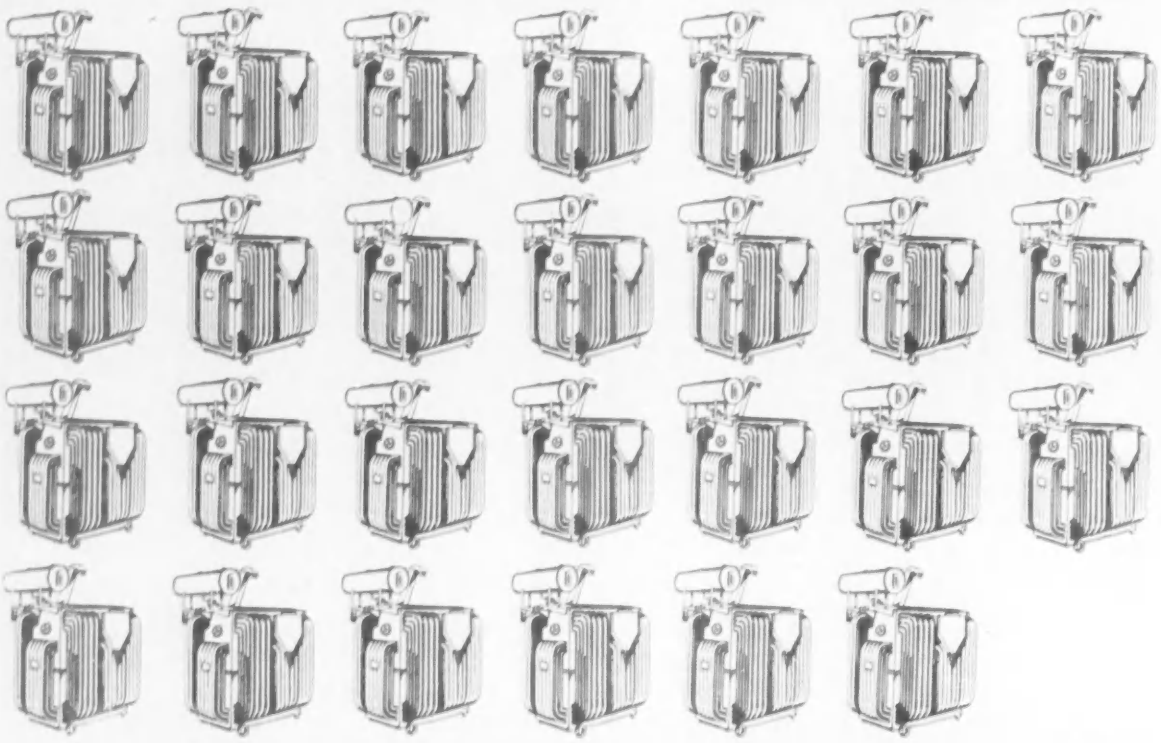
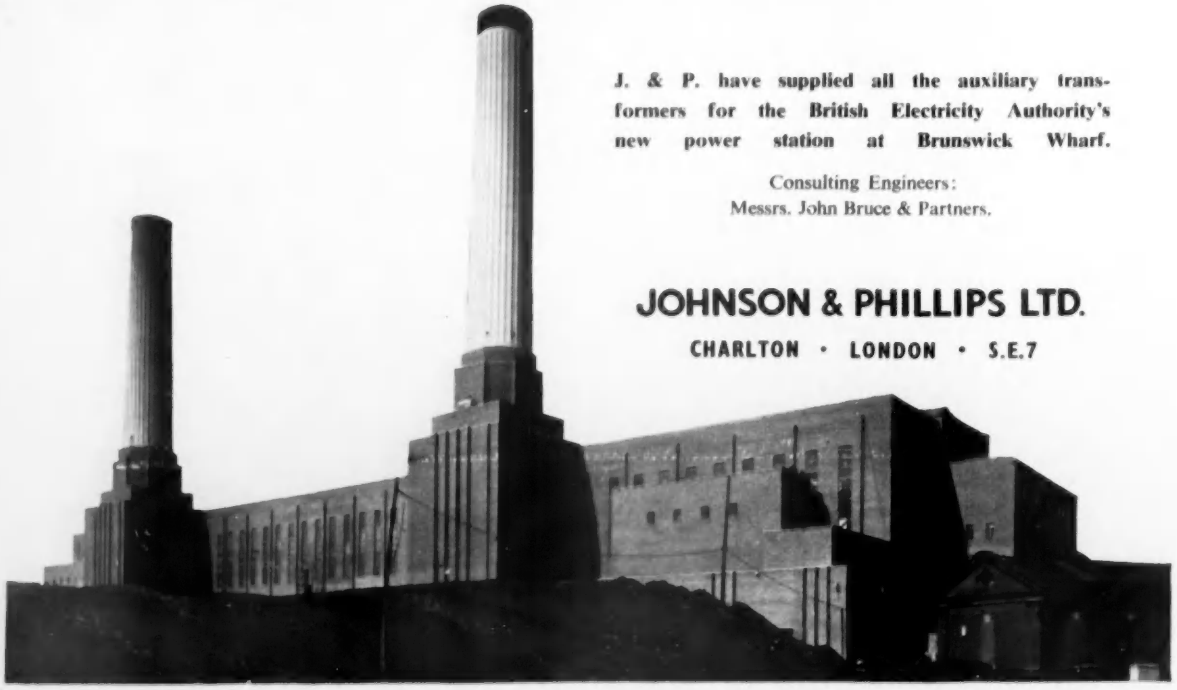


. . . 27 J.&P. TRANSFORMERS
for Brunswick Wharf Power Station



J. & P. have supplied all the auxiliary transformers for the British Electricity Authority's new power station at Brunswick Wharf.

Consulting Engineers:
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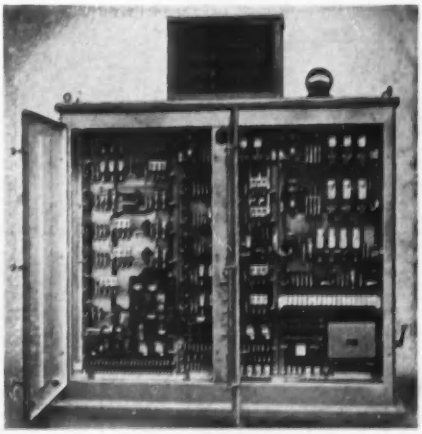

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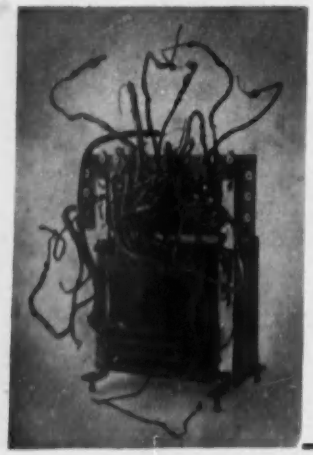
The illustrations show stages in the manufacture of transformer coils by Associated Electronic Engineers Ltd.



The leads from this Transformer — which is being removed from a vacuum impregnation plant — are covered with PERMANOID VO SLEEVING. This is made from specially compounded •Geon PVC incorporating *Diolpate*, a plasticizer which is *non-ageing, non-migratory and non-extractable.*

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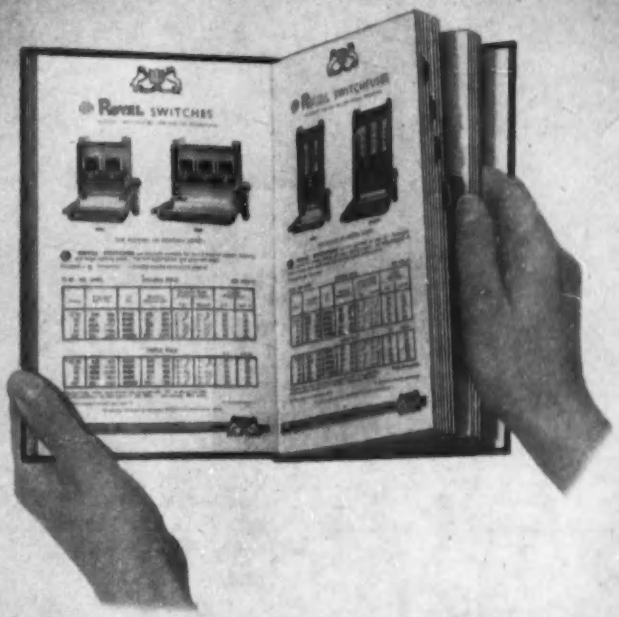

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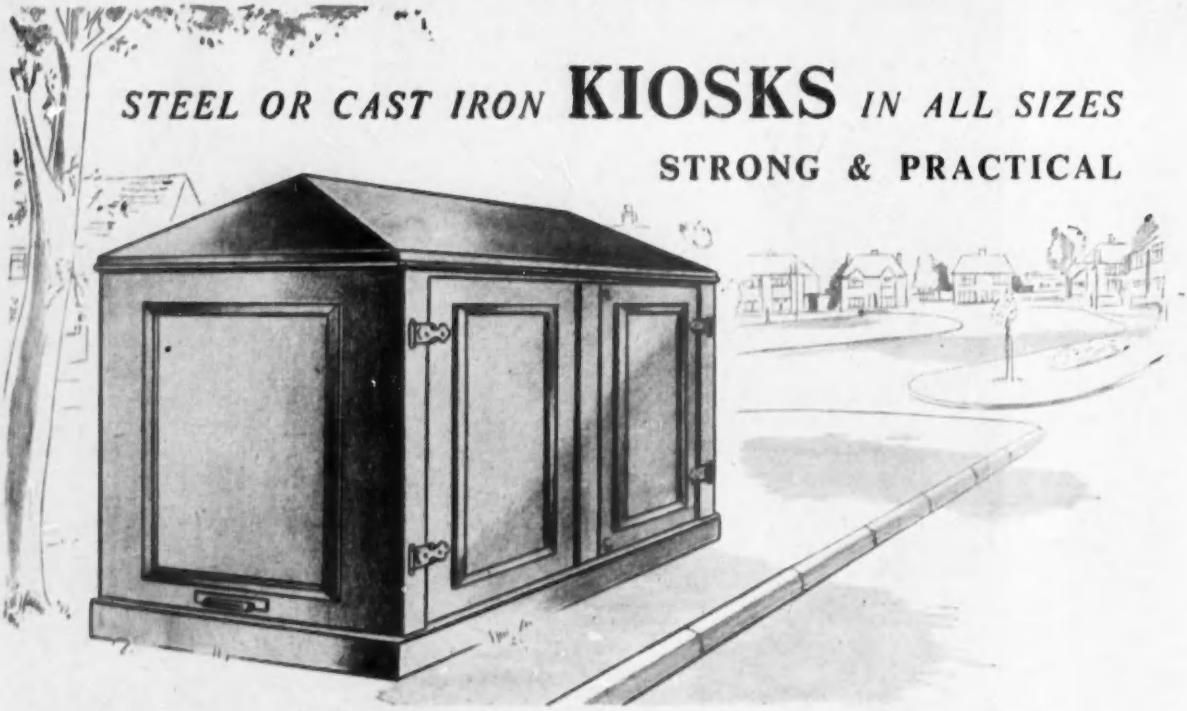

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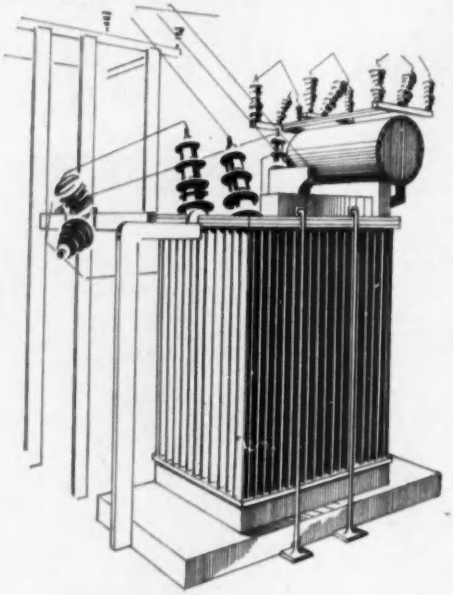

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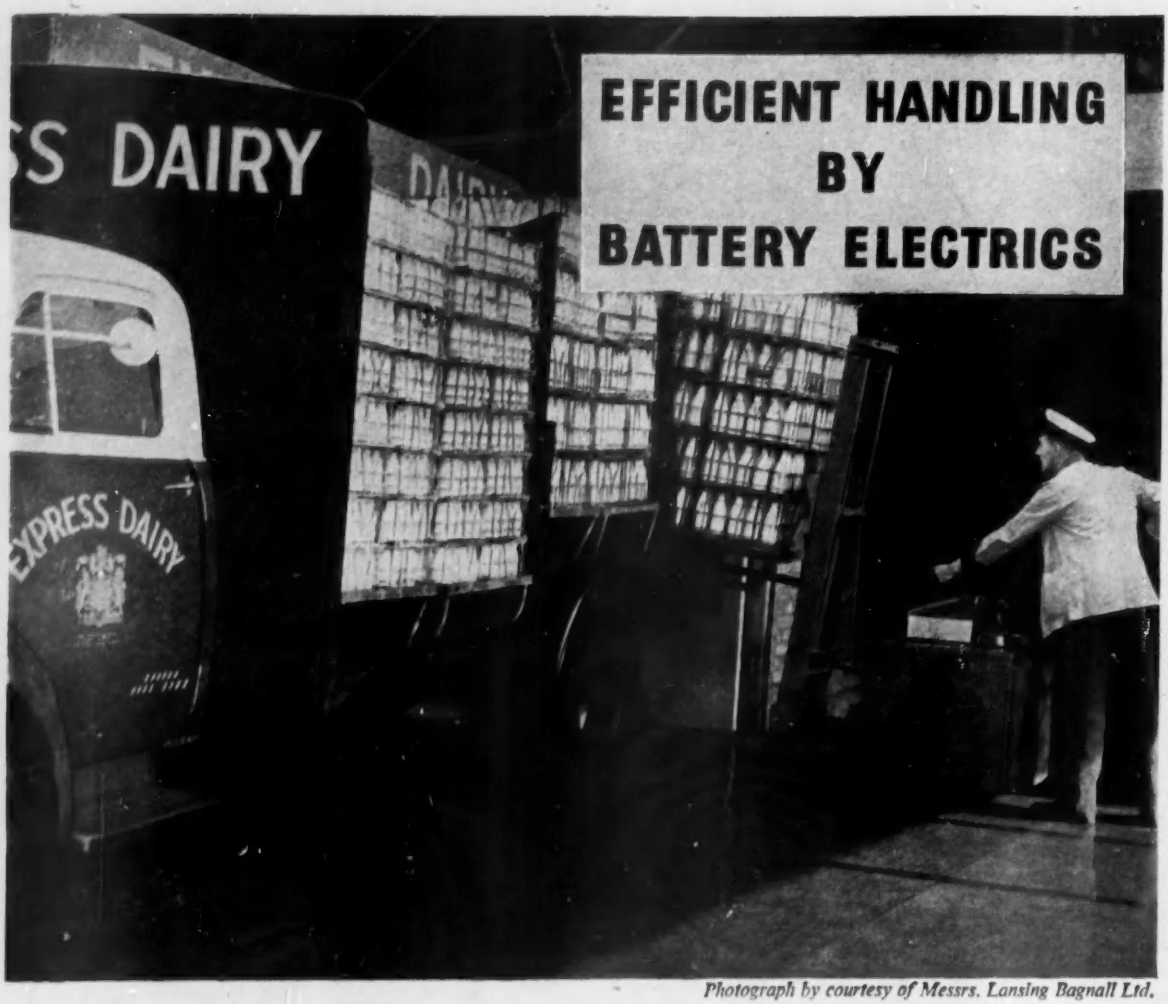

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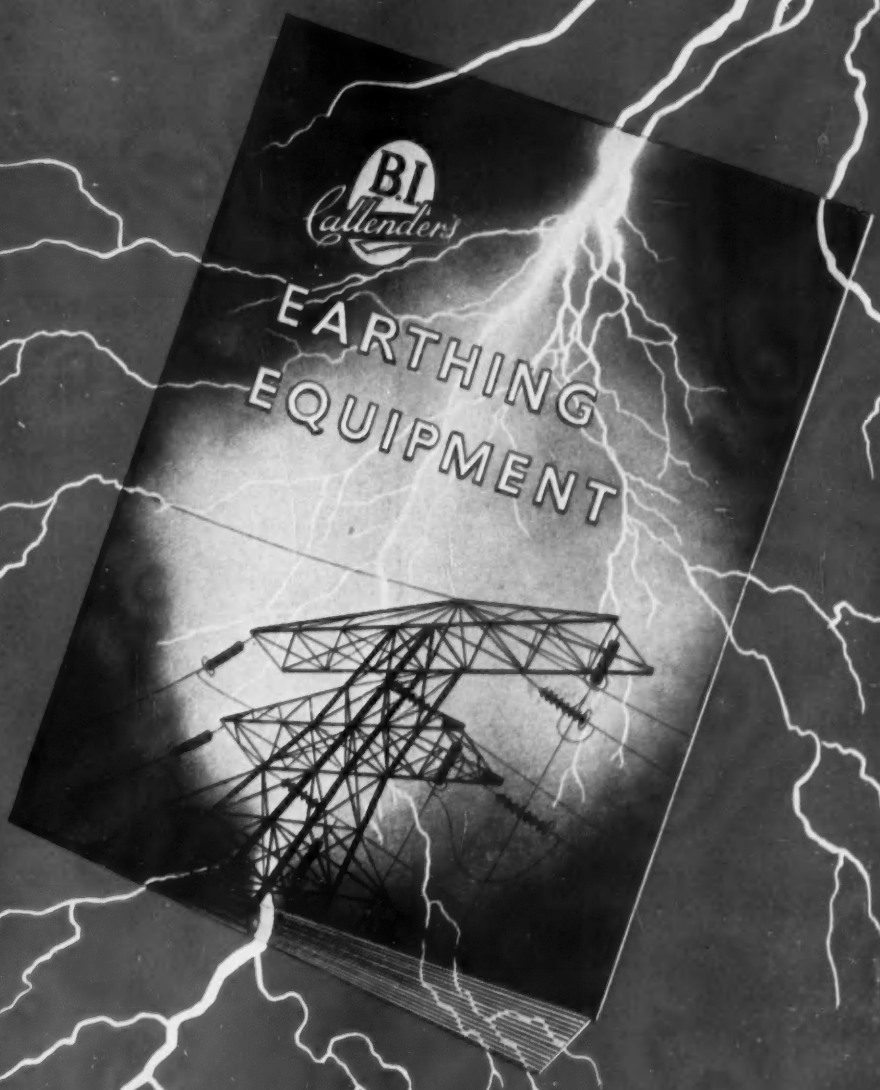

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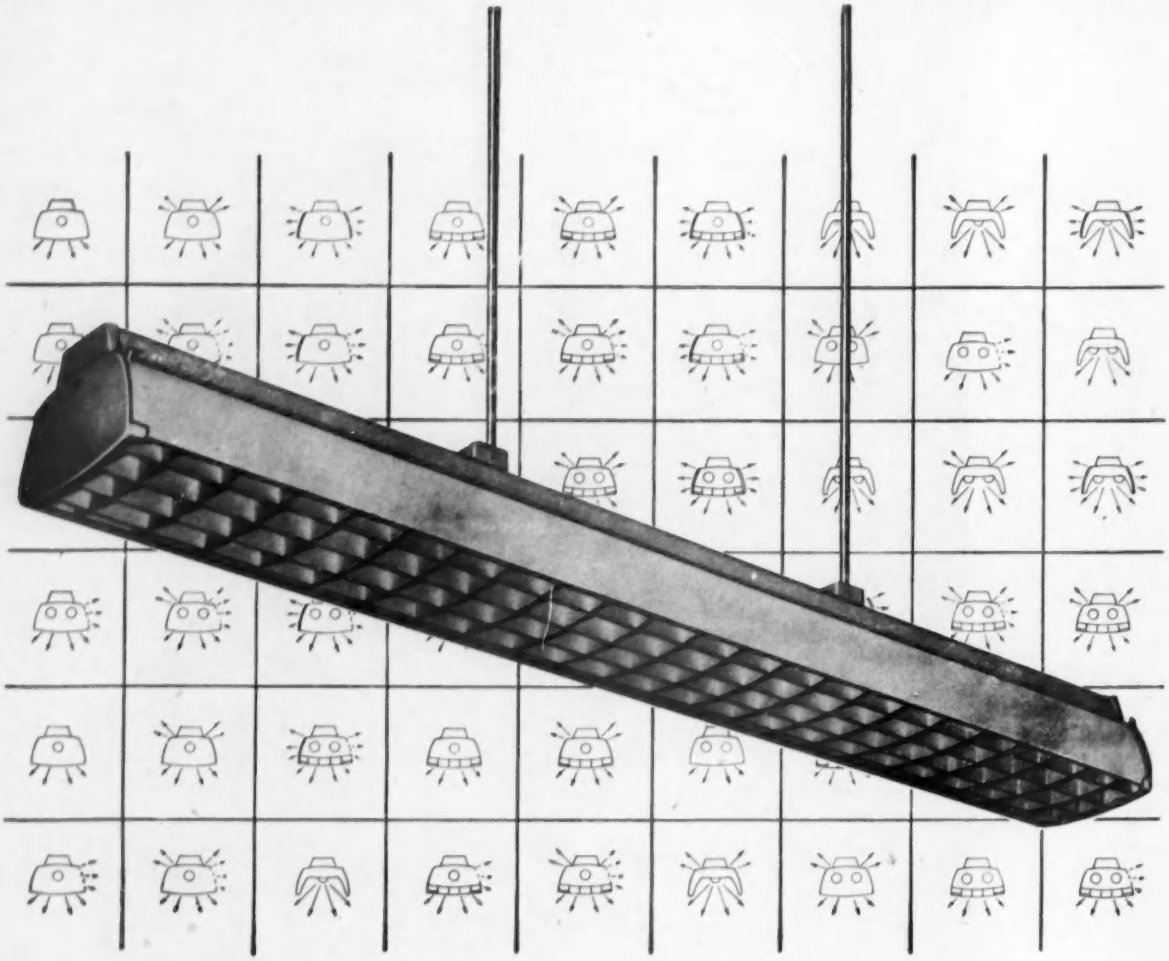

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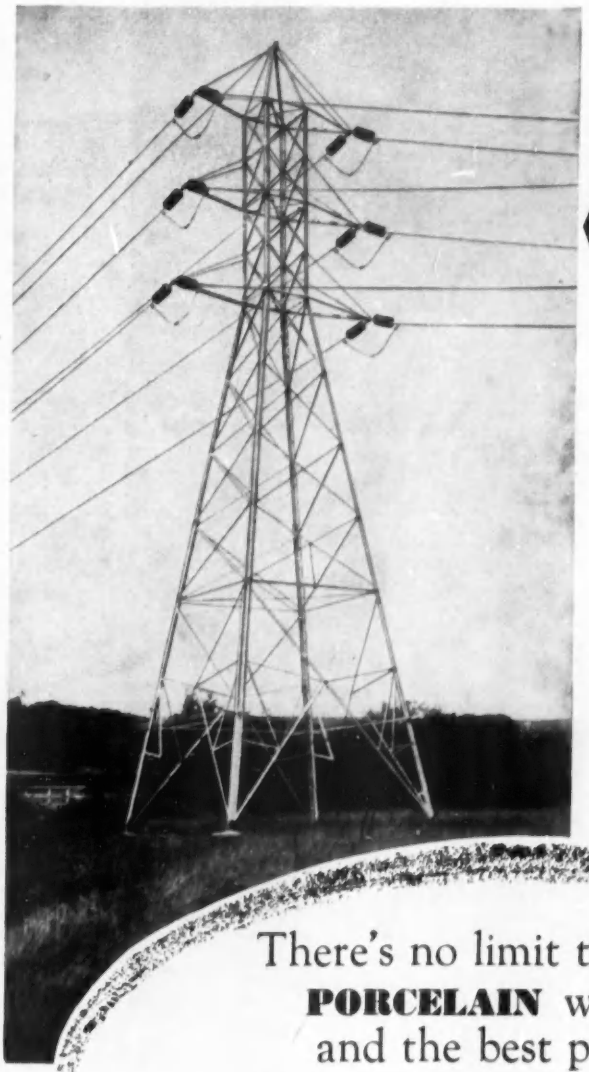

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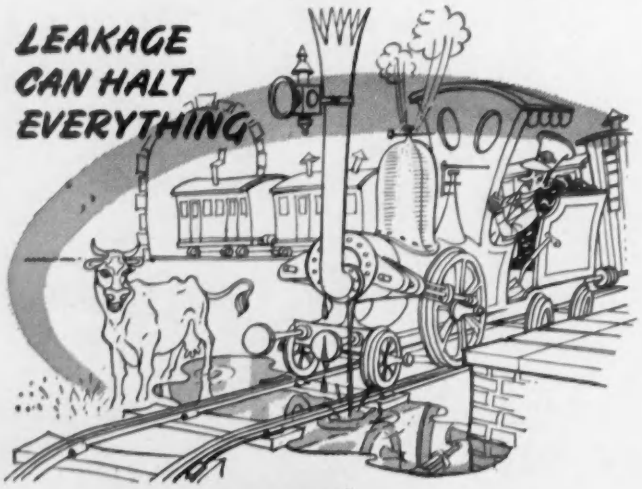

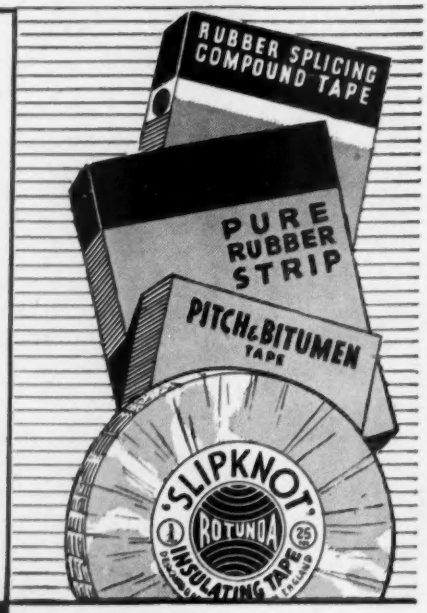

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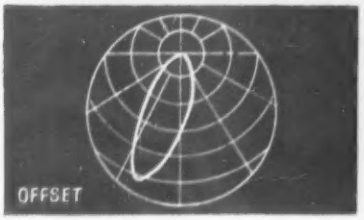

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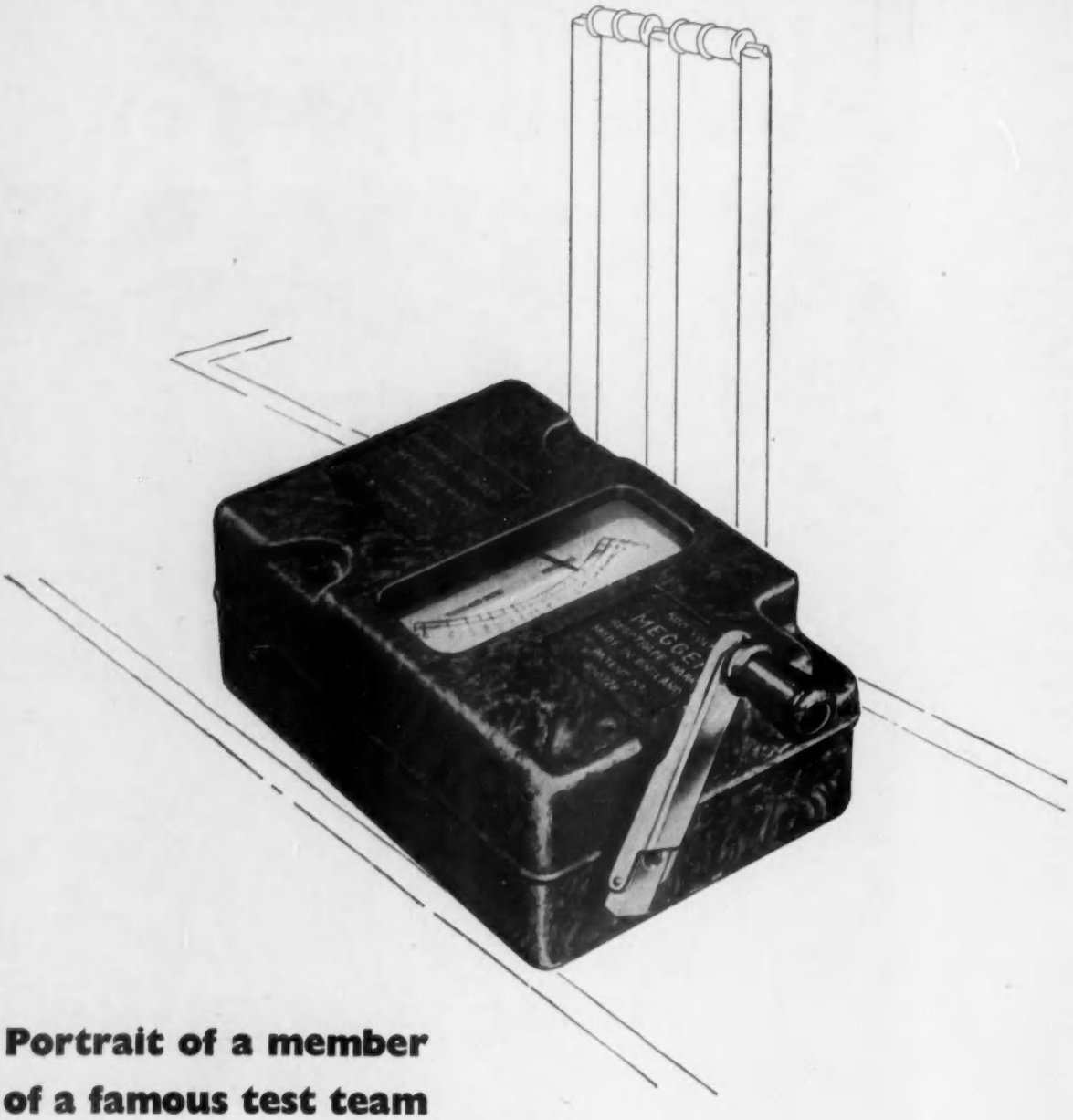

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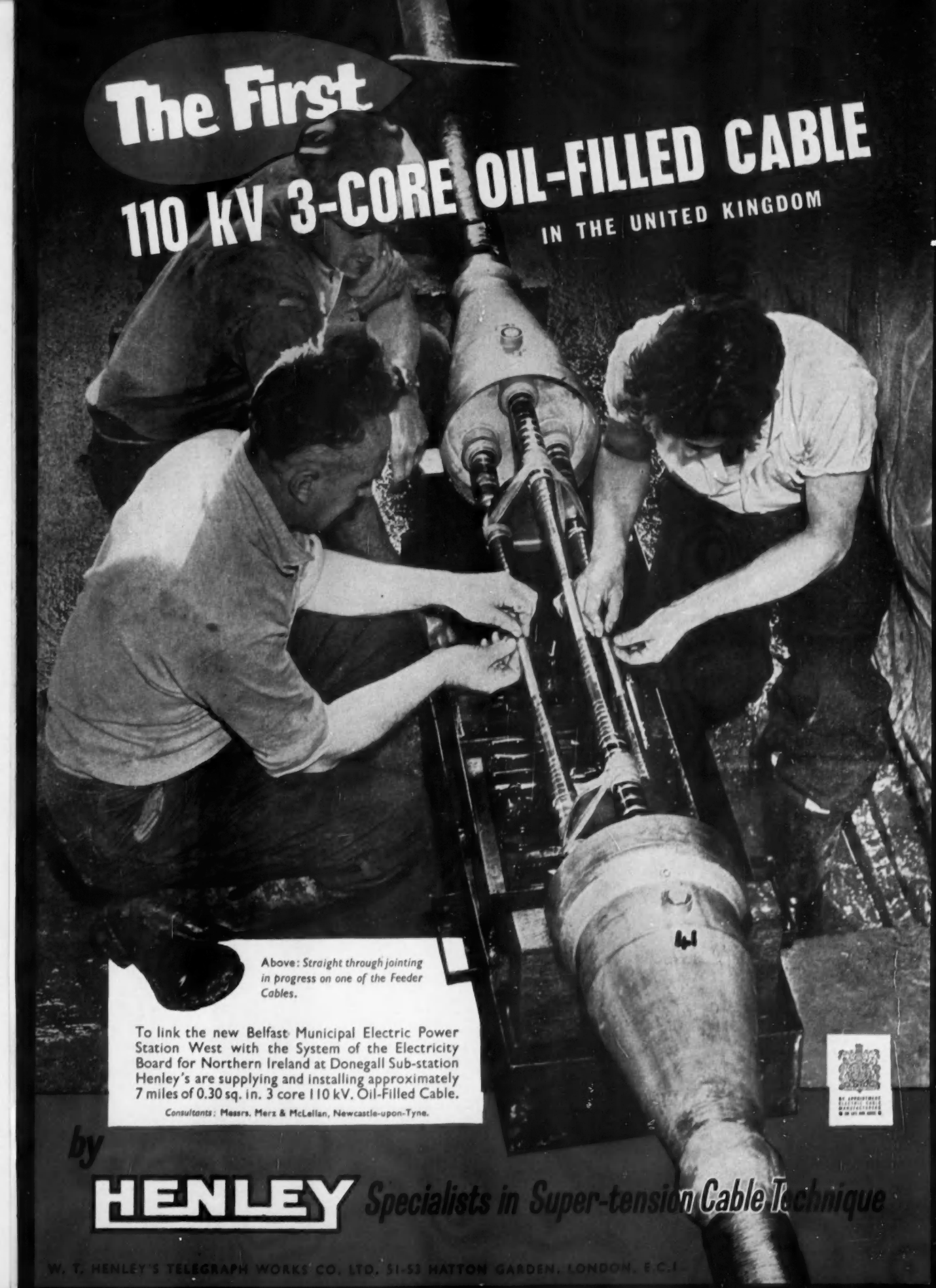

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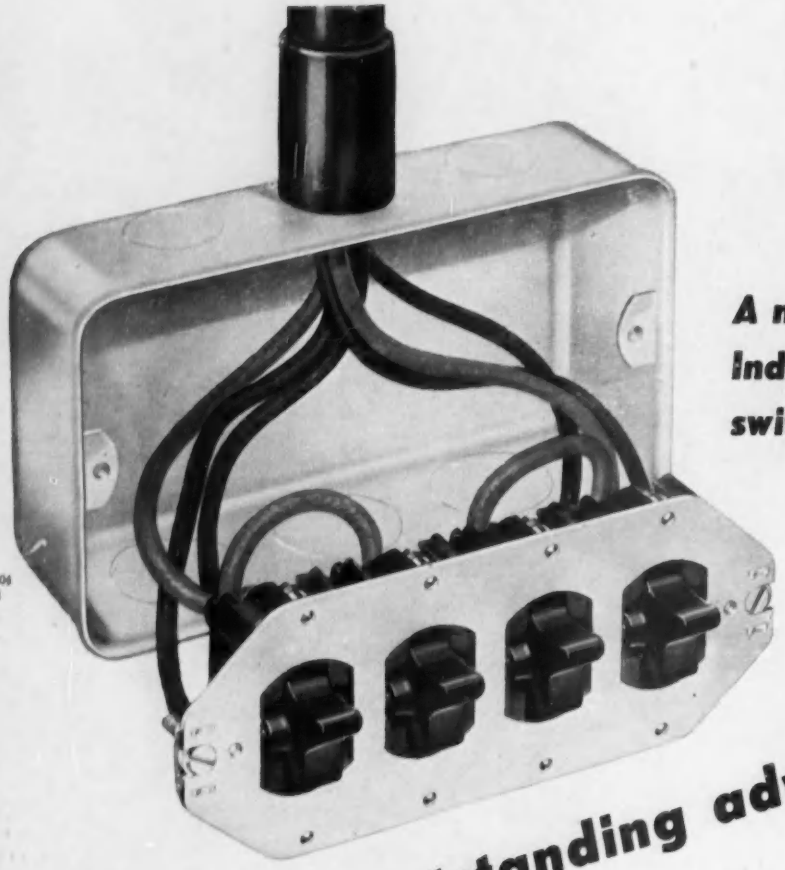

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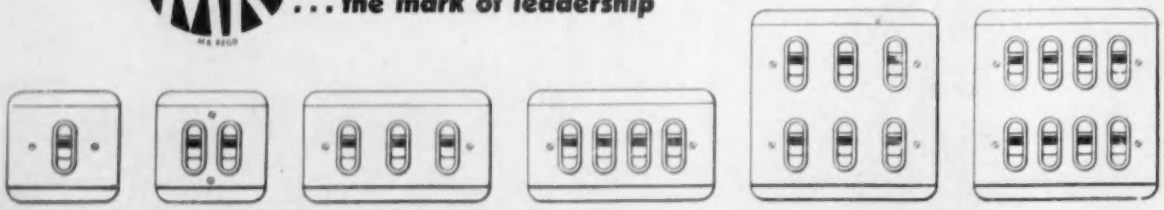

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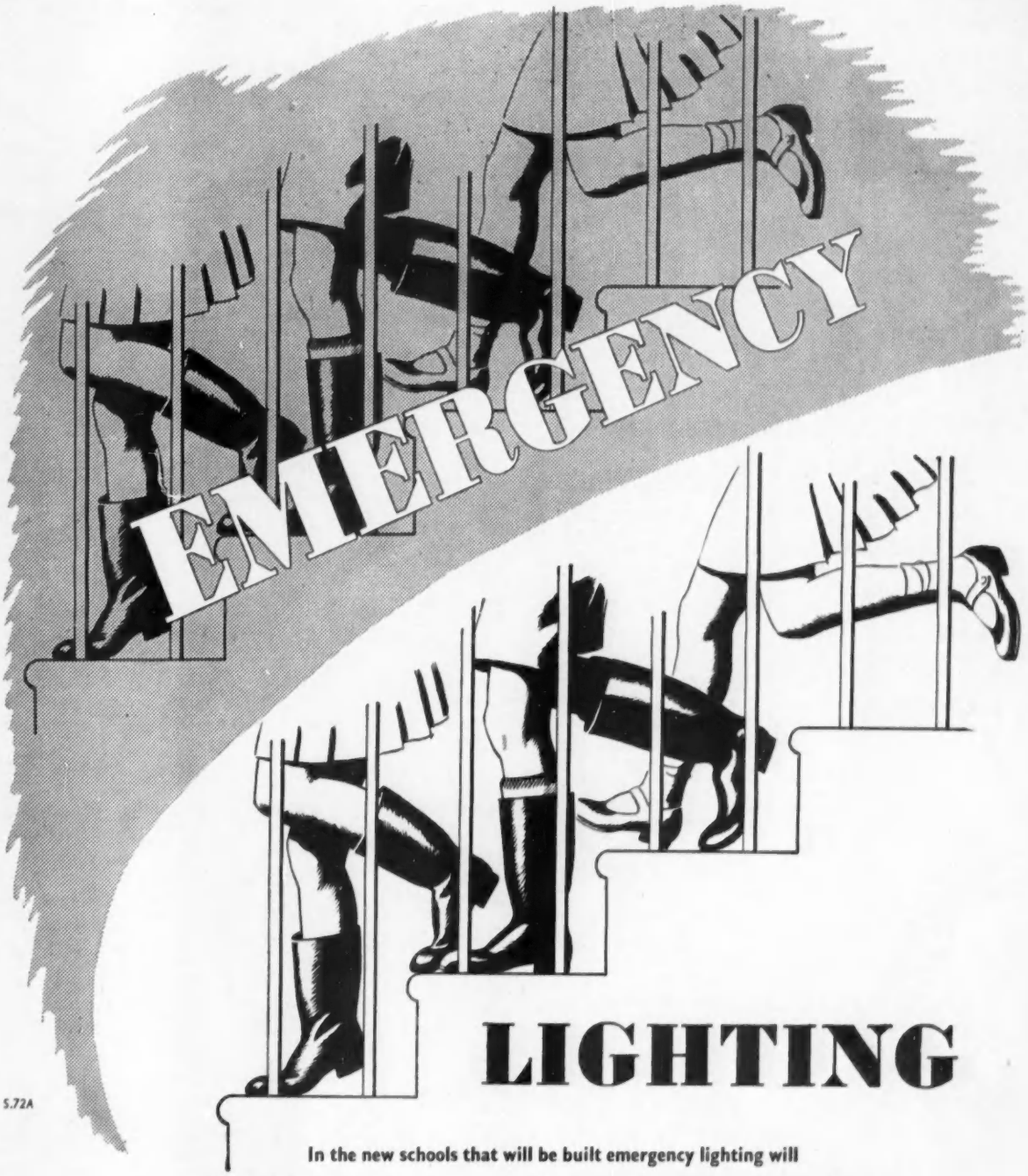

LIGHTING

S.72A

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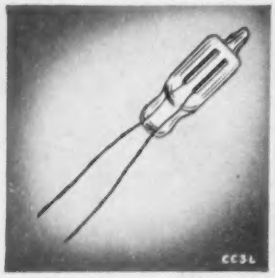

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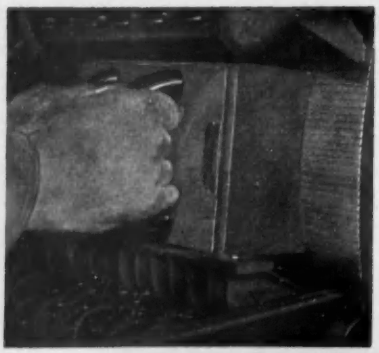

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Over 50 sizes in stock, in 2 grades: coarse and fine. 20 different types of handle.

Over 25,000 regular users all over the world.

We also manufacture a range of Mica Undercutting Tools, both power and hand types, as well as Tool Holders for Commutator turning and grinding.

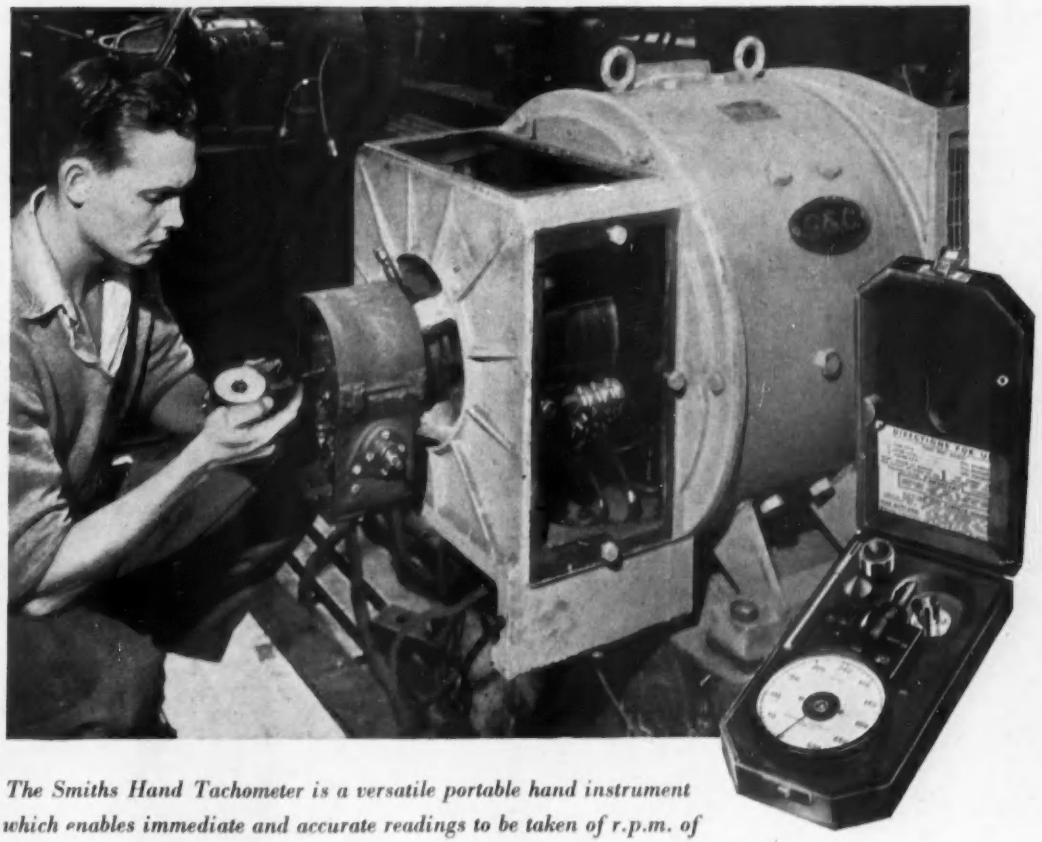
Send for details.

MARTINDALE ELECTRIC CO. LTD.
45 WESTMORLAND ROAD, LONDON, N.W.9
also at 25 ELMBANK STREET, GLASGOW, C.2.

are SMITHS instrumental

G.E.C. measures speed with Smiths Hand Tachometers

The Hand Tachometer shown here is being used to measure the rotational speed, during normal testing, of a G.E.C. 10 kW, 125 volt exciter, which forms part of a motor generator set.



The Smiths Hand Tachometer is a versatile portable hand instrument which enables immediate and accurate readings to be taken of r.p.m. of shafts, or feet/metres per minute of belts, irrespective of the direction of rotation. Readings may be taken in obscured positions by pressing a button to lock the pointer at the reading. Write now for leaflet Y.596 giving details of four models covering 0-50,000 r.p.m. Price: Net £12.12.0. complete with accessories and case.

SMITHS

SMITHS INDUSTRIAL INSTRUMENTS LTD.

Chronos Works, North Circular Road, London, N.W.2.
Northern Sales Office: York House, 12 York Street, Manchester.
The Industrial Instrument Division of S. Smith & Sons (England) Ltd.

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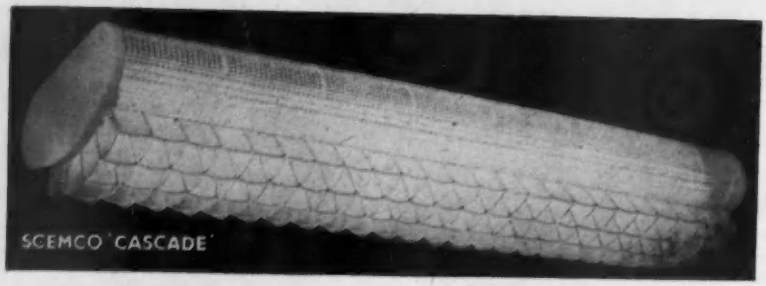

Caviare

or

BREAD and CHEESE?

. . . as with food so with
Fluorescent fittings, finesse always
attracts the better type of business

Thus we introduce:—

SCEMCO "CASCADE"

(All Plastic Diffuser) FITTING

TWIN LAMP 5ft. 80 watt £15·15·0 list
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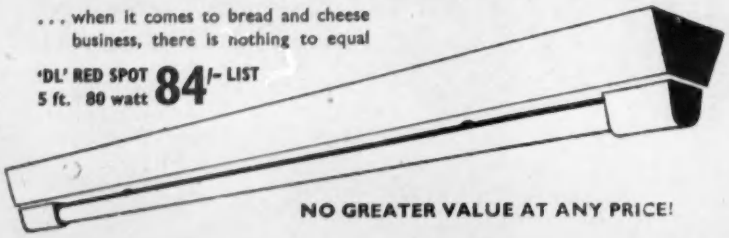
TWIN LAMP 2ft. 40 watt £10·17·6 list
TWIN LAMP 2ft. 20 watt £10·10·0 list

The SCEMCO selection enables you to meet every type of demand

FITTINGS TO SUIT ALL REQUIREMENTS from:—

. . . when it comes to bread and cheese business, there is nothing to equal

'DL' RED SPOT 5 ft. 80 watt 84/- LIST



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FAIR PLAY

SWITCH BLOCKS
built of* KILN DRIED *timber
STAY FLAT
AND CORRECT SHAPE

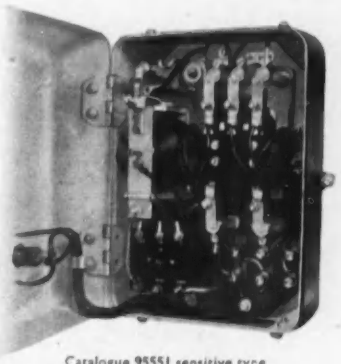
We invite your enquiries

WOOTTON & CO. LTD.

ALMA WORKS, PONDERS END
MIDDLESEX
TELEPHONE: HOWARD 1858

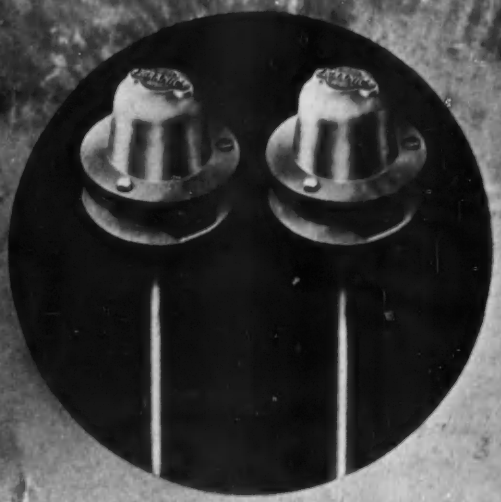
taking the rough with the smooth

There is nothing temperamental about Igranic water level control. It takes the rough with the smooth and operates equally positively no matter how turbulent the conditions. For accurate, trouble-free service wherever automatic operation on changes of water level is required, Igranic DIPSTICK water level control provides a ready solution to all problems.



Catalogue 95551 sensitive type DIPSTICK water level control rel.y

DIPSTICK WATER LEVEL CONTROL



The electrode holders are substantially designed with cast iron body and robust moulded insulators.

MOTOR IGRANIC CONTROL

IGRANIC ELECTRIC CO LTD HEAD OFFICE AND WORKS BEDFORD

EXPORT DEPT VICTORIA STATION HOUSE 191 VICTORIA STREET LONDON SW1 CABLEGRAMS IGRANIC LONDON

BRANCH OFFICES LONDON BIRMINGHAM BRISTOL CARDIFF EAST ANGLIA GLASGOW LEEDS MANCHESTER NEWCASTLE SHEFFIELD

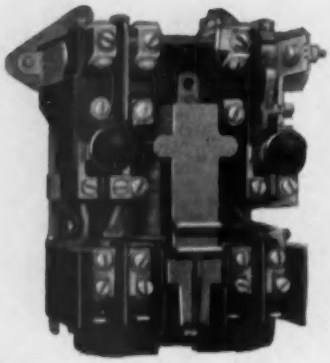
(ONE OF THE METAL INDUSTRIES GROUP OF COMPANIES)

IG3 303

A. C. Direct-on-line CONTACTOR STARTER Type DOC71

for single-phase or polyphase non-reversing squirrel-cage induction motors.

This new starter is elegant in appearance, sturdy in construction, and dependable in operation. It is available for motors up to 5 horsepower, and complies with BS.587 for "Frequent Duty", i.e. forty starts per hour.



The starter, comprising a triple-pole contactor with normally-open auxiliary switch and triple-pole hand-reset thermal overload relay, is enclosed in a distinctive die-cast aluminium case with integral START-STOP push buttons.

Up to 5 h.p. 200-550 volts
25-60 cycles

DELIVERY FROM STOCK

Member of the AEI group of companies

THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND

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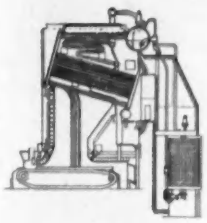
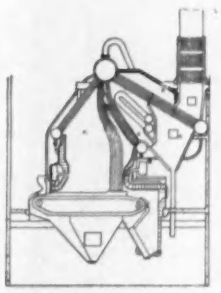
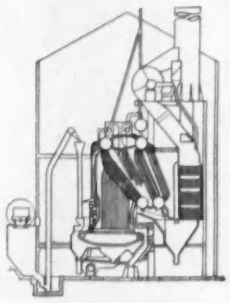
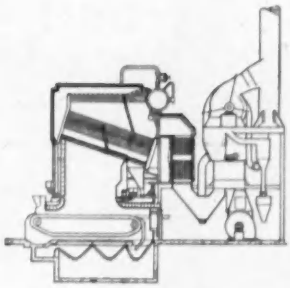


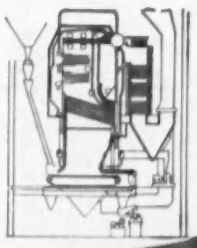


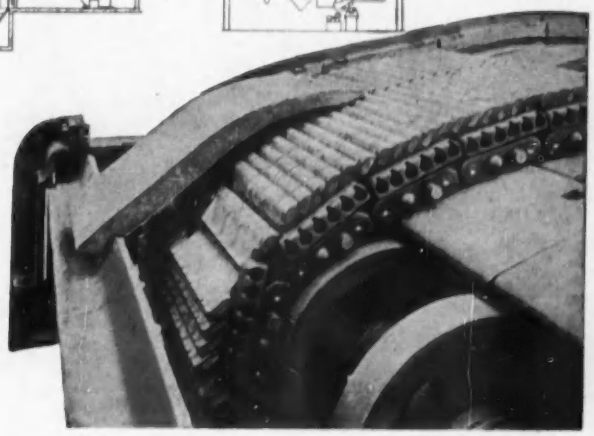
An Stoker for them all

For every known design and size of water-tube boiler there is a highly efficient 'L' type travelling grate stoker.









View of the rear end of an 'L' type travelling grate stoker

Close control of air supply

Automatic cleaning of fire bars

Burns efficiently any fuel from refuse to anthracite

Remarkably low maintenance, with parts requiring attention easily accessible

Please apply for full technical data

The result of Enterprising Engineering by

INTERNATIONAL COMBUSTION PRODUCTS LTD

LONDON OFFICE: NINETEEN WOBURN PLACE, W.C.1. Works: Derby, England; Port Elizabeth, South Africa; Sydney, Australia

A Clear Case for

CRITCHLEY

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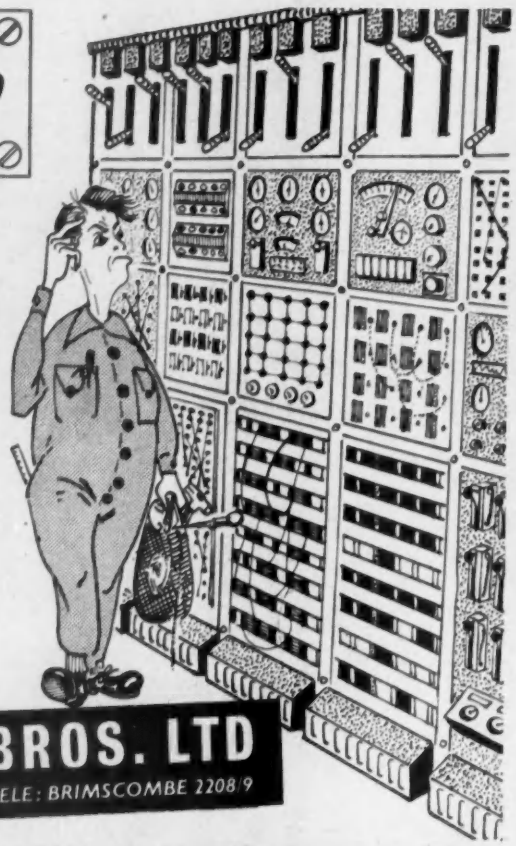
Manufactured from laminated plastic material, in a wide range of colours, and engraved to requirements. Supplied with self-tapping screws.



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DURABLE
AVAILABLE IN VARIOUS COLOURS

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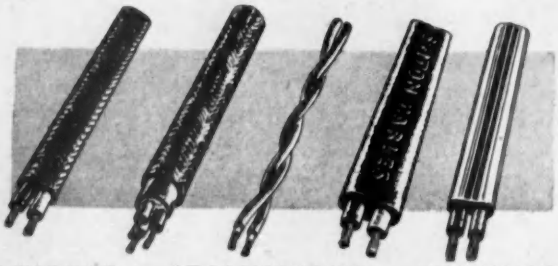
GOOD CONTRACTORS USE ASHTON CABLES

ASHTON has those important qualities which enable first class electrical installations to be made in less time. Ask your wireman to compare ASHTON with other cables and he will tell you it is easier to handle and quicker to install. The insulation can be easily and cleanly stripped with the minimum of effort. And, of course, these cables are made to B.S.S. 7 1953, with laboratory controlled production to ensure that ASHTON remains the supreme name in power and lighting cables.

use and specify

Ashton

CABLES and FLEXIBLES



MADE BY AERIALITE LTD. · CASTLE WORKS · STALYBRIDGE · CHESHIRE

This is an advertisement of the Aerialite Ltd. Group of Companies

C.107.J.Y.

SPARTAK play under REVO FLOODLIGHTS

Russian players train at Tipton

Because of the excellent facilities provided by the Revo Electric Company's Floodlit Sports Arena at Tipton, the Russian Spartak team selected this ground to carry out their training (in preparation for their match with Wolverhampton Wanderers) and found the lighting to their entire satisfaction.

The experience of close on half a century in the manufacture and design of lighting equipment enables the Revo Electric Co. Ltd., to offer a first-class service and many leading clubs throughout the country have chosen Revo Floodlights to illuminate their grounds.

The company's technical staff is available to advise on all aspects of floodlighting and details and catalogues will gladly be sent to interested authorities who are invited to forward their enquiries without obligation.

(Top) Wolverhampton Wanderers playing Revo Electric Co. Ltd., on the latter's own ground.

(Centre and below) Members of the Russian team taken during their training under Revo Floodlights.

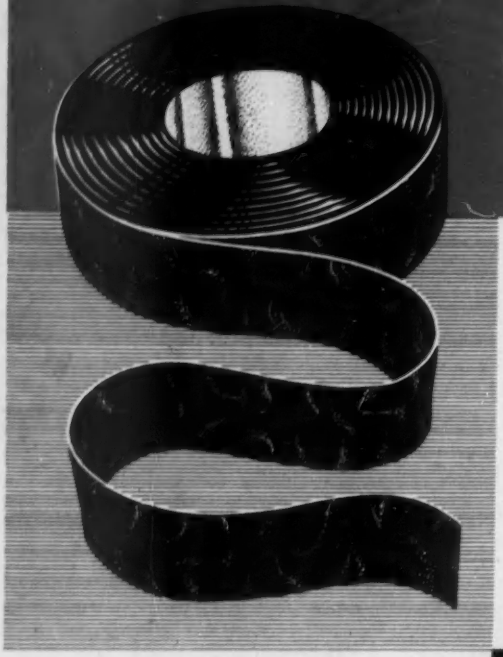
REVO REGD.

FLOODLIGHT EQUIPMENT

REVO ELECTRIC CO. LIMITED, TIPTON, STAFFS, ENGLAND

Branches at LONDON, MANCHESTER, GLASGOW, LEEDS, CARDIFF, NEWCASTLE-on-TYNE, BELFAST, DUBLIN

Makers of: Cookers, Domestic Appliances, Public and Industrial Lighting, Switch-gear, Electric Fans



Glass MICA TAPES

This Electrical Insulating Material combines High Dielectric and High Tensile Strength with Flexibility.

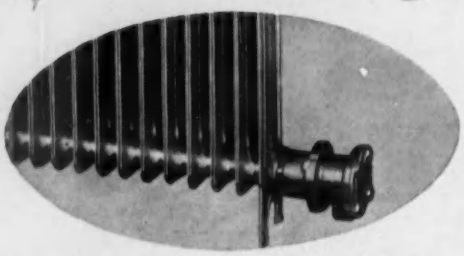
Available in 25 yd, 36 yd and 50 yd rolls in widths from $\frac{3}{8}$" upwards, with Bitumen, Synthetic or Natural Gum Bonds.

We can offer Prompt Delivery at Competitive Prices, and shall be pleased to receive your enquiries for all types of Mica Tapes.

Telephone: COPpermill 2248/9
Telegrams: Elmicmer, Easphone, London

EAST LONDON MICA WORKS
RINGWOOD RD., WALTHAMSTOW, LONDON, E.17
ESTD. 1912

NO DANGER OF FIRE with "DUNLOW" Flame Proof ELECTRIC RADIATORS



Ideal for Cellulose Spraying Rooms, Petroleum Stores, Operating Theatres, etc.

FLP ◀ **THIS IS YOUR SAFEGUARD**

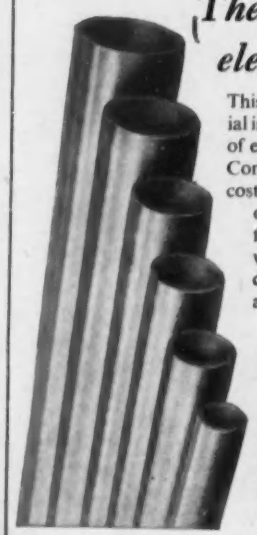
Where the risk of fire or explosion is ever present—"Dunlow" Flame Proof Heaters are your safeguard.

FLAMEPROOF IMMERSION HEATERS
certified by Buxton

"Dunlow" **DUNCAN LOW LTD**
293 BELL STREET GLASGOW C4

KEY Fibre Conduit

The Key to efficient electrical installations



This non-metallic, pitch-impregnated material is now being widely used for the protection of electrical cables everywhere. Key Fibre Conduit is easy to handle, economical in cost and eliminates any electrolytic action on the cable and is recognised as ideal for the purpose. The material is lightweight in character and bends present no difficulty. Technical advice and assistance and quotations—on application.

Key Fibre Conduit is now available in two wall thicknesses - one for laying in concrete and the other for laying direct in the ground.

Export enquiries are invited for bulk supplies against payment in Sterling. New illustrated folder gladly supplied on request together with details of the greatly reduced prices available as a result of home production.

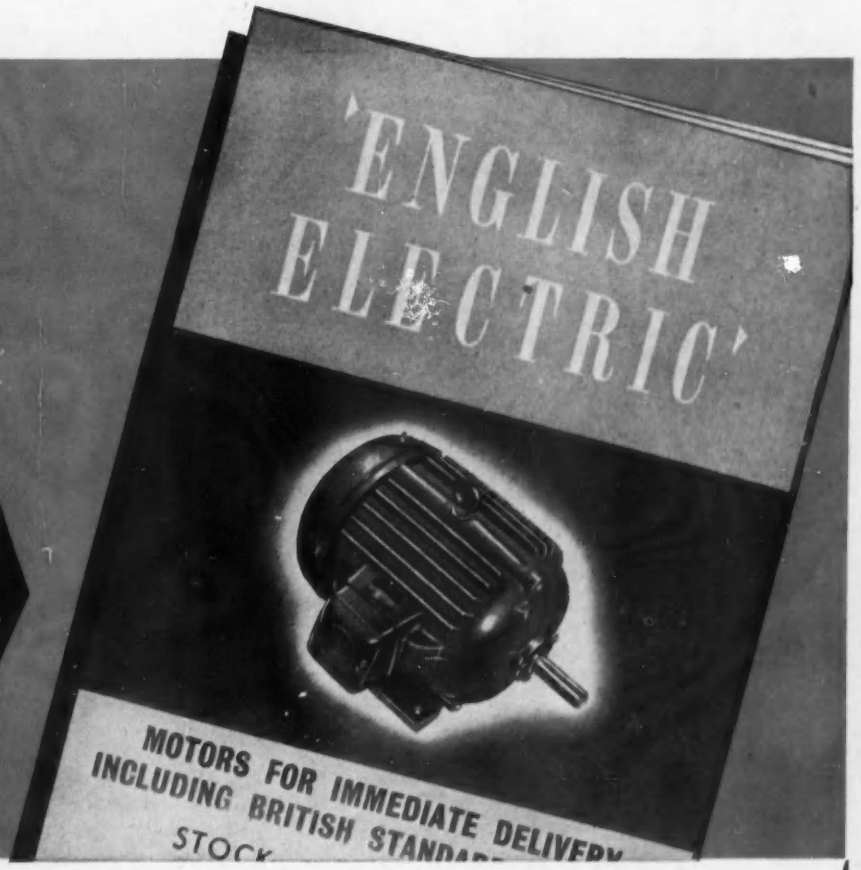
The illustration above shows Key Fibre Conduit laid on a bridge by Westminster Electric Supply Corporation Ltd.—48 years ago.

THE KEY ENGINEERING COMPANY LIMITED
4 Newgate Street, London, E.C.1. *Tel:* City 1185-6-7
Telegrams: "Keypoint, Cannon, London".
Also at: Elevator Road, Trafford Park, Manchester, 17. *Tel:* Trafford Park 1003

1,000 BRITISH STANDARD DIMENSIONED motors always available...

Immediate delivery from stock

Have you received your monthly stock list?



'ENGLISH ELECTRIC'
industrial motors

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Industrial Motor Works, Bradford

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Dear Sirs,

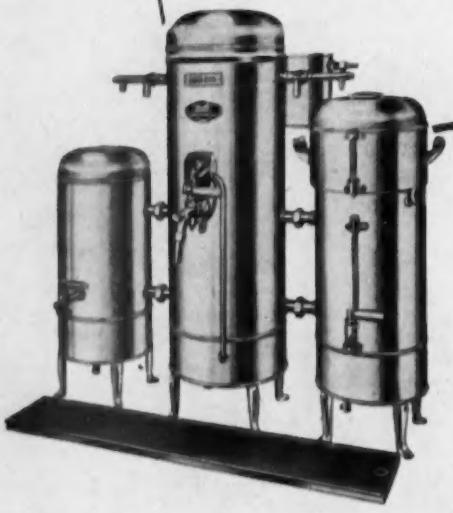
I want a really good boile
tea and coffee making in our
must be simple to operate, rec
easily cleaned.

Above all it must be we
last a very long time.

What do you recommend?

Yours faith

Proprieto



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RECOMMEND Jackson Boilers

- ★ Craftsman-made from finest materials, ensuring long life of trouble-free service.
- ★ Simply designed with minimum number of working parts.
- ★ Require little maintenance.
- ★ Absolutely reliable at all times.
- ★ Extensive after-sales service available.
- ★ 'Filtomaton' Drip-filtration system of coffee-making for pure coffee of a consistently fine quality.

There's a 'Jackson' made for every catering need. 'Jackson' Boilers are supreme for all hotel and restaurant catering, cafes, milk bars, works canteens, hospitals and schools.

Jackson Boilers

Jackson Boilers Ltd. Vulcan Works, Shafton Lane, Leeds 11
Telephone 3-1088

Showrooms: **25 Victoria Street (entrance in Abbey Orchard St.), Westminster, S.W.1; 202 Corporation Street, Birmingham; 28 Deansgate Arcade, Manchester; 9 King Street, Leeds; 219 West George Street, Glasgow; 142 Victoria Street, Bristol.**

9484 Hours NON-STOP On Full Load

On **JULY 6TH 1953**

Off **AUG. 5TH 1954**

at AGECROFT "B" Power Station

On July 6th, 1953 at 13.40 hours this Metropolitan-Vickers generator was put on load at the British Electricity Authority's Agecroft 'B' Generating Station. Not until 17.45 hours on August 5th, 1954 was it taken off load—solely for routine annual overhaul. It had then been running continuously for 9,484 hours during which 465,693 MWh were generated with an average loading of 49.1. According to the Chief Generation Engineer, there was no reason why the machine should not have gone on running had the situation required it.

The Agecroft 'B' machines are two-cylinder 3,000 r.p.m. turbines, designed for 600 p.s.i.g., 850°F., driving 50 MW, 33 kV air-cooled main generators, and 2.5 MW, 3.3 kV house generators. The condensing plant and auxiliaries are also of Metropolitan-Vickers manufacture.

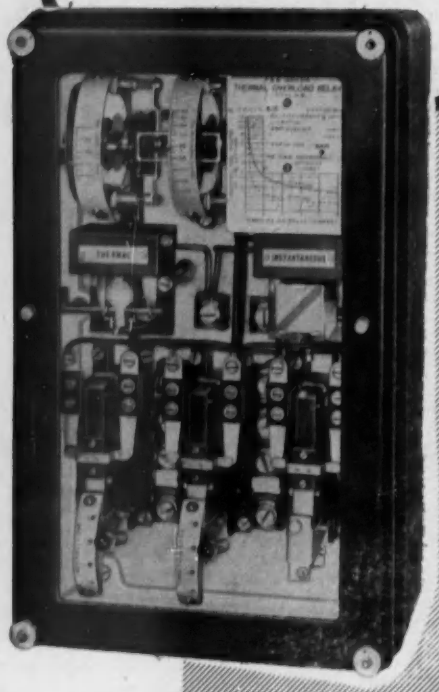
METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the AEI group of companies

Leading Electrical Progress

B/B402

PROTECT
YOUR MOTORS
with
P & B Golds' Relays



For motors with any starting periods or starting currents under extremes of ambient temperature.

Send for descriptive pamphlet

THE P & B ENGINEERING CO · LTD
CROMPTON WAY · CRAWLEY · SUSSEX
TELEPHONE: CRAWLEY 1004

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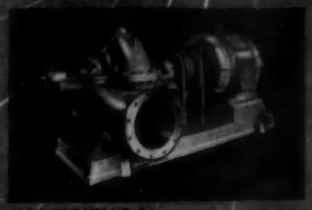
Look for the name
WORTHINGTON-SIMPSON

A name known for over a century throughout the world for active participation in the development of modern pumping machinery—every modern facility for testing and manufacturing—world-wide organization for service. These comprise the intangibles, beyond evaluation, represented by the nameplate bearing the name of Worthington-Simpson.



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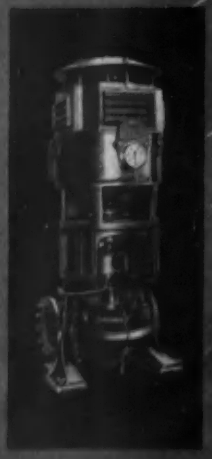
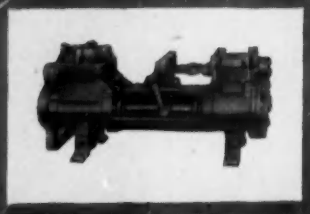
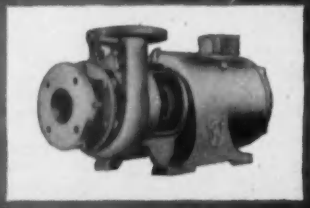


NUMARINE



STEAM

POWER



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(Pat. No. 591835)

WORTHINGTON-SIMPSON

When it's a question of pumps the engineer goes to
WORTHINGTON-SIMPSON LTD NEWARK NOTTS

modifications location points design advice
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We do the worrying for you!

Our job doesn't stop once we have delivered castings . . . sold and forgotten . . . that's NOT our way of working! We are here to give customers the service they expect, a service that continues as long as our advice is needed.

Expert technicians follow up the delivery of your castings. They are at your disposal to answer any problems you may have regarding machining, location, modifications and anything else peculiar to your own special requirements . . . in short — we do the worrying for you! Another feature of the Birmal service is our Research and Development organisation. You can obtain technical help in the development of cast components and unbiassed assistance in the selection of the right alloy and casting process.

★ *Birmal supply aluminium and magnesium castings in the sand, gravity die and pressure die process, and zinc pressure die castings.*

you get more than a casting from BIRMAL

BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY LIMITED

BIRMID WORKS · SMETHWICK 40 · STAFFORDSHIRE

EVERETT EDGCUMBE

INSTRUMENTS IN SERVICE

The illustration below shows the main load control centre of The Bristol Aeroplane Company's Power Distribution system, incorporating Diesel Generation Control.
The panel instruments were supplied by Everett Edgcumbe.

EVERETT EDGCUMBE SQUARE INSTRUMENTS. Designed for modern panels. Sizes: 3½" semi-flush. • 4" flush or projecting. • 6" flush. Insulated or metal cases. Clean, well balanced design. Smooth front without decoration. Rounded corners and edges. Maximum readability. Minimum panel space. Easy fixing. **Ammeter · Wattmeter · Power Factor Meter · Voltmeter · VAR Meter · Synchroscope · Frequency Meter Electric Clock.** For all systems and frequencies, balanced and unbalanced loads.

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Specialists in: Speed Recording, Photometry, Process Time Control, Telemetering.

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NEW ELECO "PERSPEX" FITTING FOR INDUSTRIAL CONDUIT LIGHTING

—Increases Light Output Ratio 10-15%

This new Eleco fitting (patent applied for) is efficient, versatile and economical. It can be used either open, or made completely dustproof with a diffusor cover. The reflectors are made in two grades of opal 'Perspex', whilst the covers are obtainable in three grades, including a pinspot pattern "Perspex". This means that a suitable combination can be arranged to control the percentage of upward light and brightness over a considerable area. Thus, units can be selected to give the best lighting effect for your particular installation.

TOTAL THESE FEATURES – AND YOU GET TODAY'S MOST EFFICIENT LIGHTING

For 100 to 500 watt tungsten Lamps, 80-125 watt MB/V Mercury.

Lighting output Ratio exceeds 85%. Balanced distribution — 10-25% upward light.

High mechanical strength — Resists corrosion.

Low initial cost.

Ease of installation.

White stove enamelled interior.

For further particulars or help on any lighting problem write to:

ELECO

ENGINEERING & LIGHTING EQUIPMENT CO. LTD.

SPHERE WORKS, ST. ALBANS, HERTS.

TRANSFORMER CAPACITY OF OVER 5,000,000 kVA per annum

The main erection bay with special impulse testing station in foreground.

The Ferranti transformer factory at Hollinwood covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment.

FERRANTI

A view of the Ferranti Transformer Factory at Hollinwood.

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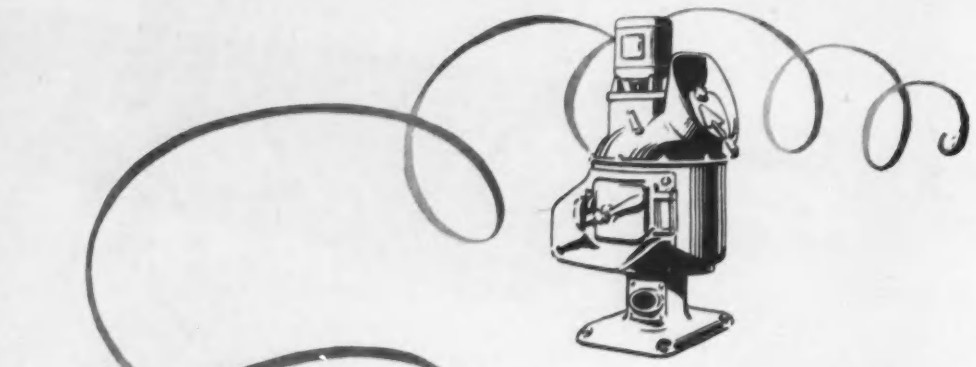

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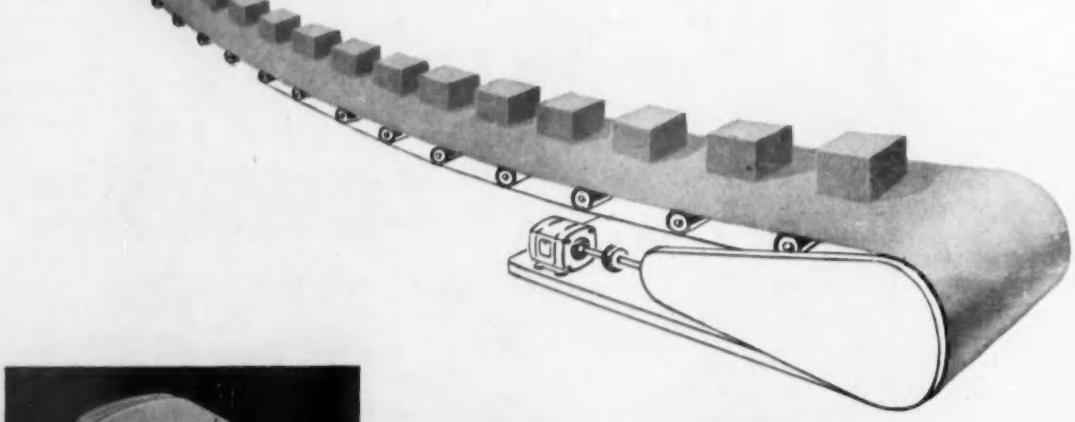

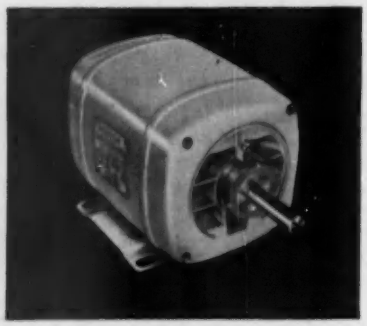

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NEW YEAR PLANS

Amongst the new features planned for this journal in the coming year, is a series of articles commencing in this issue, and affording a unique study of power station construction. This series is designed to show the inside story of the planning, design, progressing and eventual commissioning of a typical station of today's building programme. Of necessity the earlier articles will be more general in character, and the first deals primarily with the load forecasting procedure on which the ultimate need for a new station is based. Marchwood, the station selected to illustrate the planning and constructional techniques used by the B.E.A., is at present under construction and the further articles in this series will appear at about two-monthly intervals, timed to end in the early post-commissioning period of the station. Throughout this project, we have been offered the closest co-operation of the B.E.A. and the Southern Division to whom we must express our deepest thanks. In other electrical fields also, plans are being made for the coming months. One of the principal factors of today is the greater accent on selling, and with this in mind, later in January, there will appear the first of a series on sales and showroom policy. In these and other ways we plan in 1955 to extend our service to all sections of the industry. We wish all our readers a Happy and Prosperous New Year; our aim is to make it one in which they will find the ELECTRICAL TIMES increasingly of service to them.

BEAUTY AT A PRICE

The National Parks Commission has a statutory duty to raise the alarm whenever the natural beauty of an area is threatened by some development. An instruction of equal weight requires the B.E.A. and the area boards to bring electricity as economically as possible to country dwellers. It is not surprising that the two interests frequently clash; what is particularly pleasing is that a reasonable compromise is so often reached. That this is so is revealed in the fifth report of the National Parks Commission, published recently, where there is testimony to the smoothness of relations now existing between the Commission and area boards. Well over 1,000 proposals for electrification referred to the Commission during the year ended September 1954 were agreed readily and in private. Moreover when the parties have proved unable to come to terms, there has been a reasonableness in the approach of the Commission that some non-statutory bodies of self-styled country-lovers would do well to copy. The sincerity of an opposing viewpoint is recognised, and if

necessary, the matter is referred to the responsible Minister for a decision. This is a better approach for maintaining goodwill than a prolonged public haggle, and one less likely to impair the responsiveness to considerations of amenity which, as the report explicitly recognises, area boards show. But it adds the expense of delay to the many direct costs which a co-operative approach to amenity-sensitiveness incurs for electricity supply. There can be no close estimate of the total cost to consumers of departing from optimum engineering designs to meet less tangible considerations, but it must be considerable and it deserves more frequent emphasis.

ADEQUATE WIRING BY LAW

Electricity supply undertakings in the United States have been campaigning for many years to encourage consumers to increase the capacity of their circuit wiring, so that the purchase of new appliances shall not be put off because of installation shortcomings. Recent reports suggest that they have achieved a startling success in New Jersey, where one borough council has been considering a proposal that its building by-laws should be modified to require services to dwelling houses to have a minimum rating of 100 amps for a 240/120 V three-wire supply. This compares with the 60 amp basis of the B.S. Code of Practice. Moreover, this basis of comparison leaves the difference under-stated. Where the minimum requirements for distribution boards set out in the American proposal and the B.S. Code are compared, the discrepancy is even greater. The one requires provision for at least one 50 amp three-wire circuit and one of 25 amp together with two 20 amp and ten 15 amp two-wire (120 V) circuits, while the other is satisfied with capacity for three 30 amp and two 5 amp circuits. There are, of course, many arguments for incorporating such a minimum in building regulations, but so far as electricity is concerned, these are probably better restricted to ensuring safety without attention to convenience—a point our American contemporary *Electrical World* makes—though the two cannot be entirely separated. What is particularly interesting to a British observer, however, is that a local authority has been so thoroughly persuaded of the advantages of adequate wiring as to consider taking such strong action. This contrasts strongly with experience in this country, where electricity boards usually have to take an extremely firm attitude in order to get local authorities to install a reasonable electrical installation in their own houses.

FACTORY DEPARTMENT DELAY

Year by year the annual report of Her Majesty's Chief Inspector of Factories gives a broad review of developments in British engineering. It can be read with profit by all engineers, for its approach nowadays is not confined to a narrow consideration of safety. Behind the comments culled from the countrywide experience of nearly 400 inspectors lies concern with smooth and efficient working as well as with the avoidance of accidents. The report for 1953, which is reviewed on a later page, is a fair example of its kind, made more interesting because it devotes special attention to electrical developments, and in particular, passes a favourable verdict on the effectiveness of electronic control equipment used in heavy industries. Yet this very quality of the report makes less understandable the delay which seems always to attach to its publication. Appearing last week, the report for 1953 is just a year out of date. This is six months better than the report for 1952, but it is far from being good enough. If nationalised industries can finalise both reports and accounts within six months or so, surely the record of the industrial safety year, with no financial analysis to worry about, can be prepared and printed more quickly? The electrical industry has a particular interest here, for that valuable annual publication of the Senior Electrical Inspector, "Electrical Accidents," can never appear until after the parent report is available and by then it is sadly out of date.

NUCLEONICS FOR ISOLATION

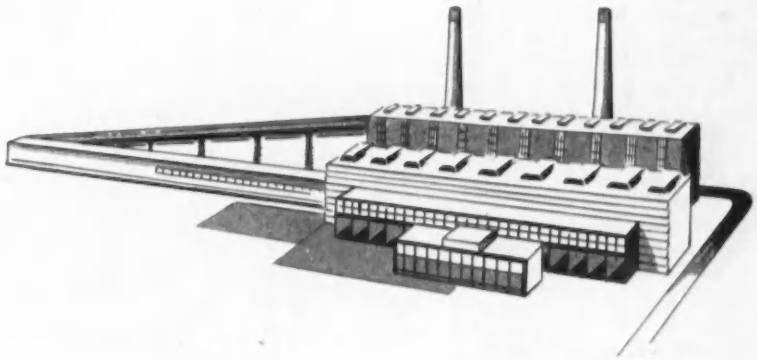
It has always seemed likely that one peaceful outlet for nuclear materials would be their use for power generation in the less accessible parts of the world; in Arctic regions, desert wastes, and extensive jungle areas where the delivered cost of more bulky conventional fuels is excessively high by the difficulties of transport. Because of its high energy/mass ratio, fissionable material has a *prima facie* attractiveness in such conditions, and recent reports from the United States indicate that its suitability is soon to be tested. The American Atomic Energy Commission has placed a contract for the design and building of what is described as a small packaged reactor that can be transported by air. At present military uses are in mind, specifically the generation of energy at Arctic communication bases where the price of fuel oil can be as high as £15/barrel because it has to be flown in; but the project will provide costing statistics and operating experience which will give a measure of the future commercial possibilities of compact nuclear generating units for isolated sites of a non-military nature. It is noteworthy that no one seems to doubt the possibility of producing such machines: only their economic practicability is in question. That surely is a significant comment on how the possibilities of nuclear energy are opening up.

QUINTESSENCE OF THE METRO

Rush hour travelling on any urban underground is far from pleasant, but with a charming thought the French are now attempting to delight the olfactory palate of the travelling public. After what must have been exhaustive investigation, it has been decided to add that essence of Spring, youth and sex as distilled in the French perfumier's art, to the thousand and one odours which make up the unique atmosphere of the Paris Metro. This rare blend, which has been unfairly described as "stale air, stale breath and stale garlic" differs no more than qualitatively from those endured in other cities but only in Paris itself could such a solution be found. Less romantic undertakings might essay the scientific approach of deodorisation by ozone or even the questionable effect of chlorophyll but would any of them go so far as to think of identifying their separate routes by individual perfumes so that literally the traveller has only to follow his nose?

Meteor

BUILDING A POWER STATION PART ONE



First Steps in Planning

IN the same way that a turbo-alternator requires a large amount of auxiliary plant to ensure its efficient and reliable operation, so does a power station need a vast quantity of administrative and organising work in its planning and construction. This background work, so vital to electricity supply as a whole, can seldom be appreciated in its entirety by those whose task is concerned mainly with day-to-day building and operation. The purpose of this series of articles is, therefore, to present, as far as possible, the broad outline of the planning work and procedure which has now been established by the British Electricity Authority for power station construction. This will be continued with a particular study of one specific power station, which will be followed through from site selection to commercial load. The station has been selected as being representative of good modern practice, being of unit design with stop-valve steam conditions of 900 lb/sq in., 900° F, and is the Marchwood Station of the Southern Division. In this first article, the question of load forecasting will be considered, but initially it may be useful to review part of the background leading to the present position.

The Background

A convenient starting point for the survey is 1926 when the Electricity (Supply) Act resulted in the setting up of the Central Electricity Board, to co-ordinate generation through the means of a high-voltage grid. The earlier attempt at encouraging interconnnection, by the 1919 Act, had not proved the success it was anticipated and so the next step of planning generation on a nation-wide basis was introduced. Means then became available to direct the operation of power stations, and, through the Electricity Commissioners, to effect some measure of control over the erection of new stations having regard to overall efficiency. During the years that followed considerable progress was made in the attention to more suitable siting of power stations and in reducing the overall margin of spare plant. The C.E.B. was initially organised to operate through nine regional areas—although these were subsequently reduced to seven—which were effectively self-contained units, interconnected for emergency purposes only.

By the late thirties, however, there was a feeling that the supply industry was ready for a further synthesis and the McGowan Report of 1936 recommending regionalisation of distribution was a manifestation of this. The proposals however, were not generally acceptable and the second World War postponed any further possible legislation until the full step of nationalisation was taken in 1948. It was, however, with the Central Electricity Board that the first major step towards national planning was taken as distinct from the control exercised since 1919 by the Electricity Commission. Consideration of power station sites was thus no longer necessarily confined to local supply authorities and even though the time for erecting stations was much shorter than today, the need for long term planning of plant construction became apparent. To this end a load forecasting technique was established by the C.E.B. shortly after its formation. This service has been continued by the B.E.A. and expanded to meet the more onerous conditions of modern load programming.

Load Forecasting

It is in load forecasting that a power station has its inception. On the estimate of the demand to be met in the years ahead will depend the size and location of new stations, the capacity of extensions to existing plant, the development of distribution systems and, indirectly, the extensions of manufacturing capacity at makers' works. Load forecasting is a continuous process. It can be as short-term as the day-to-day working used by system operation engineers to give power stations their daily loading instructions, and as long-term as the estimates required for a national project such as the 275 kV supergrid. Indeed for general policy work, estimates necessarily tentative, may be prepared for over twenty years ahead. The subject is thus immense in scope, and affects all branches of the supply industry.

In one form or another load forecasting has been carried out from the early days of electricity supply. Then, however, it was a comparatively simple matter, depending mainly on the extrapolation of local load curves of the previous few years. As the size and complication of sets increased, however, deliveries became longer, and the

financial investment greater. Now, when several years are needed for the construction of a new station and forecasts have to be produced for many years ahead, simple extrapolation alone is no longer justified. Many mathematical attacks have been made to project the general load curve more accurately, but they must all suffer from the overriding limitation that they assume stable average conditions to continue into the future. Many variants can appear in the yearly figures of load growth due to levels of industrial activity, climate and other factors. In the last five years for instance, the national annual increase in units sold has fluctuated between 3·7 and 12·3%, while variations between individual areas have been greater. The graph shown in Fig. 1 gives the load growth in units sold from 1920 to 1954, and it can be seen how the rate of increase was altered by the depression period of the early thirties and by the war.

Forecasting Technique

The shorter the time ahead for an estimate, the more accurate it is likely to be. Within the electricity supply industry short term forecasts are produced by the System Operation Branch of the Chief Engineer's Department of the B.E.A. One of the functions of this branch is concerned with day-to-day operation and it receives through intelligence from the grid supply points a continuous picture of the demand of the country as a whole, and also knows where and at what time demands are likely to arise. The records show trends in such matters as time of peak loading, changes in daily load factor over the year, effects of temperature and wind velocity, all of which, when analysed, provide fundamental data on which longer term forecasting can be based. The estimates produced by this department in the spring have been found to give a remarkably accurate picture of the situation as it occurred in the following winter. The System Operation Branch is of course particularly important in long term planning, as in many cases the final siting of plant is dependent on factors which are its particular concern. Such a factor as the integration of generating plant into the transmission system, for example, may have a decisive effect.

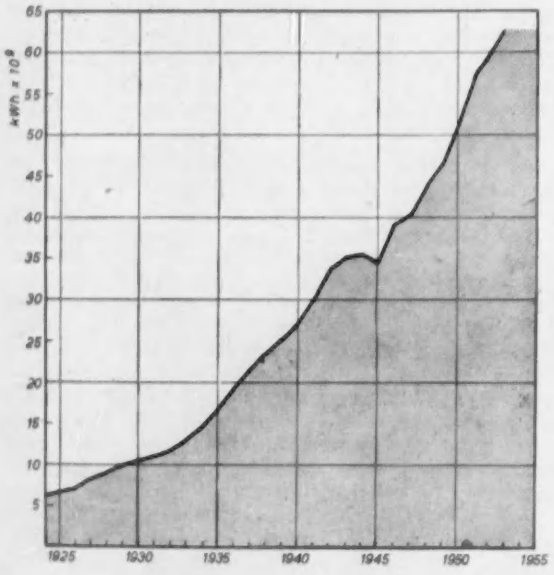


Fig. 1. Growth in electricity consumption (from authorised undertakings)

For longer term forecasts necessary to meet plant programming two different approaches are made. One of these originates with the electricity boards and provides detailed forecasts for each year up to some six years ahead, with global forecasts for a following period of seven years, while the second, produced by the Commercial Manager's Department can be taken even further with, inevitably, diminishing accuracy. The two methods have been in use for many years and are subject to continuous investigation and modification in order to improve their accuracy and to cope with the changing structure of the industry.

Prior to nationalisation the Central Electricity Board supplied some 543 authorised undertakings who took power through 300 supply points. In order to be able to carry out advanced planning the undertakings were asked to provide details of the estimated growth at each one of these points, giving both unit figures and maximum demand. This task occupied no less than 200 planning staffs scattered over the country. Now this duty has devolved on the fourteen electricity boards, who supply area figures to the Central Authority. The data on which their figures are based are obtained from the extrapolation of unit sales and kW demands in various specific categories (domestic, commercial, industrial, transport, and public lighting), modified in the light of local knowledge of proposed future development in the areas concerned, such as the establishment of new industries, factory extensions, new housing schemes and local government projects.

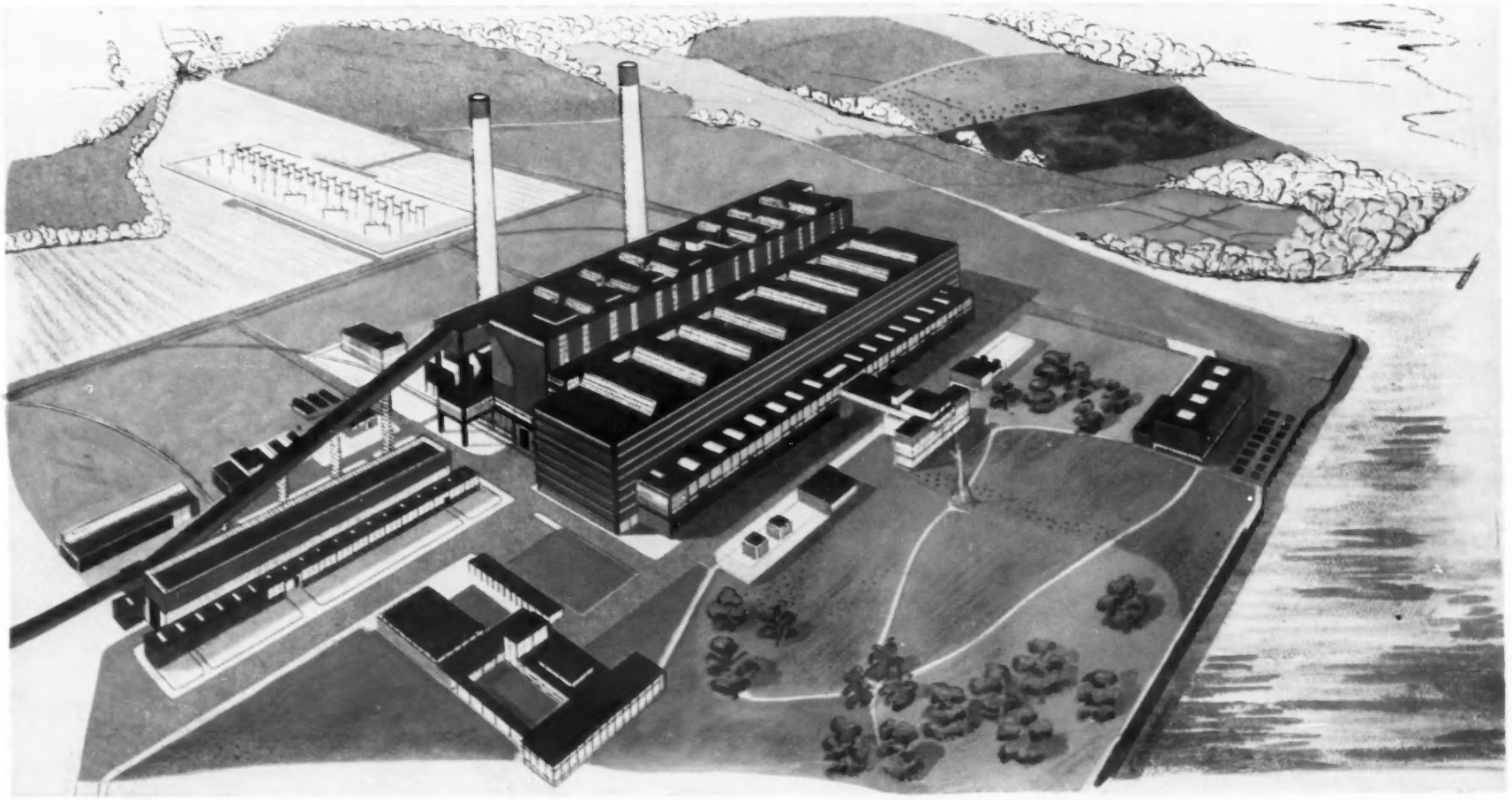
The second method is based on an estimating service which was originally established by the C.E.B. soon after its formation, and is now taken over by the Commercial Department of the B.E.A. This service prepares both regional and national estimates of load and consumption and uses techniques similar to those adopted for market research surveys. It is entirely independent of the local load estimates prepared by the area boards and thus provides a most important complementary figure. From the industrial, domestic, commercial and other data which come forward in this estimating service, the probable future course of the five specific categories is assessed and then the likely rates of growth in sales output and demand is determined.

Sources of Error

Both systems are of course liable to error. In the figures submitted by the area boards for example, errors in estimation can arise from the fact that up to last year, true maximum demand figures had not been available because of the abnormal conditions of plant and transmission capacity shortage under which the industry had been compelled to operate. Load shedding effects have had to be estimated in terms of peak loading and demand, a difficult if not impossible task to carry out on a local scale to a degree of accuracy sufficient for precise forecasting. There is also the possibility that a particular prospective industrial load may be duplicated due to enquiries having been sent to more than one area board by a manufacturer who has several possible sites in mind. Further there remains the vital fact that consideration cannot be taken of the effect of national economic factors, such as investment limitations, political policy, trade prospects in various industries, international trading agreements and so on. Nevertheless, the area board estimates provide a most valuable contribution to the solution of the general equation.

In the market research techniques, national trends may be taken into account more easily but there are residual factors difficult to estimate. Political considerations may for example largely upset ahead planning.

MARCHWOOD POWER STATION



Scheduled for eight 60 MW generating sets, the station is being engineered by the Southern Division of the B.E.A. Our articles on power station construction will in their later stages refer specifically to the building of this plant.

In this artist's impression, produced by Farmer and Dark, the consulting architects, the general arrangement of the buildings can be seen. An unusual feature is the extensive use of glass and aluminium as cladding materials.

The Electrical Times 6 Jan. 1955.

In the first years after the war the task of programming was simplified by the overall shortage of plant. It became effectively less a case of planning for adequate plant to meet overall requirements of future electricity demand, than of building up to the limit set by manufacturing capacity and governmental authorisation. The problem initially, therefore, was not so much a matter of determining the global total of plant to be commissioned in any one year but rather one of how the limited amount of plant should be regionally disposed to best advantage. None the less, the global estimates were essential, not only to give the future of probable development but also to provide evidence to the Government of the electrical industry's capital needs. Now, however, with plant programmes being planned six to eight years ahead, when the deficit in generating capacity will largely have been made good, (if the substantial amount of time-expired plant being relied upon is taken into account) it is the global estimates that are increasingly the determining factor in the capacity which is planned.

From Figures to Plant

The process of load forecasting is continuous, and forward estimates are continually required in the light of year-to-year experiences. All relevant figures are supplied to the headquarters Commercial Department which is

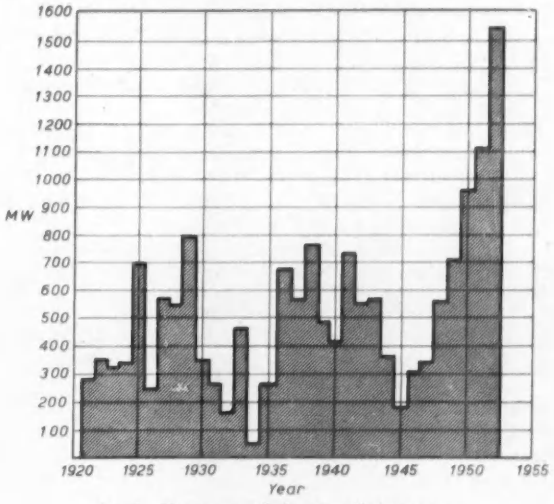


Fig. 2. Histogram of plant installed per year (authorised undertakings)

responsible for the necessary co-relation between the independent estimates. This forms the basis on which the engineering departments prepare the final figures for the formulation of plant programmes. In order to study the timing of this and subsequent procedures, it will be of convenience to take an actual programme routine; for example the eight year period up to 1961/62.

By January, 1954, the area boards will have received from their sub-areas information concerning units sold during the last quarter of the year, but this will not, of course, include the full figures for that winter. From all available data, each board will then prepare its own estimates of requirements for the following six years in detail, and the subsequent seven years as a global total. This will be notified to headquarters, together with specific information which may be of value, such as anticipated large industrial loads.

These estimates from the boards should be in the hands of the Commercial Manager's Department of the Central Authority by February. This department will also have been engaged in preparing the regional and national figures

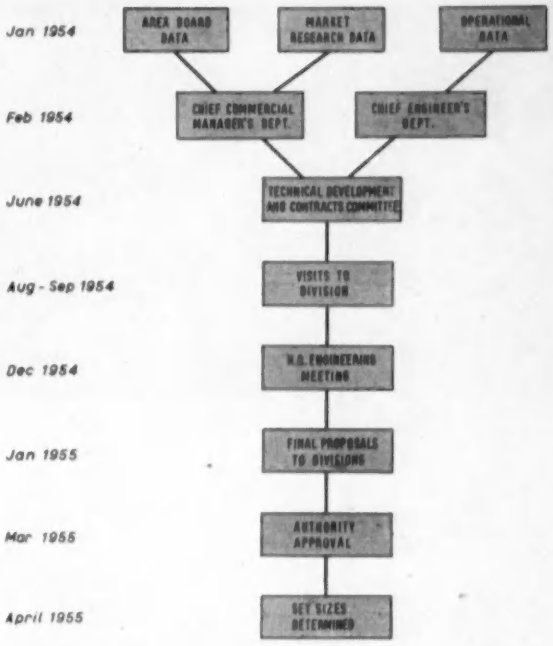


Fig. 3. Schematic progress diagram to show routine established for engineering planning at headquarters

on the basis of its own computations. The figures on all these bases are compared and compromise estimates prepared. In the light of these estimated requirements, the Chief Engineer's department assesses the overall capacity of new generating plant necessary to meet the demands in each of the winters six, seven and eight years ahead, the plant programmes for earlier years having already been approved and put in hand. In June or July 1954, a report on this initial planning work is submitted to a committee of chief officers of the Authority—the Technical Developments and Contracts Committee—at which the load estimates put forward by the Chief Engineer's and Commercial Manager's departments for the years up to 1962 are considered in detail. At this meeting the progress of new plant construction already in hand is reviewed and the total figure for new plant required in the future years under consideration is decided having regard to the load estimates and the capacity of old plant expected to become unserviceable. In making the decision, the probabilities of errors in the forward assumptions (of load, weather conditions and amount of plant outage at peak) are also taken into account on the basis of past experience.

To permit an easier appraisal of the system the programme up to 1961 is given below together with the maximum plant permissible under government sanction. It will be noticed that the first six years' figures are firm, the seventh year is scheduled "provisional" and the eighth as "tentative." It is this schedule the committee will have as a basis for their deliberations.

Year	Plant Programmes MW (s.o.)	Permitted Amount
1954	811	1,450
1955	1,597	1,550
1956	1,835	1,550
1957	1,892	1,550
1958	1,252	1,750
1959	1,759	1,950
1960 (provisional)	1,950 (approx)	—
1961 (tentative)	1,950 (approx)	—

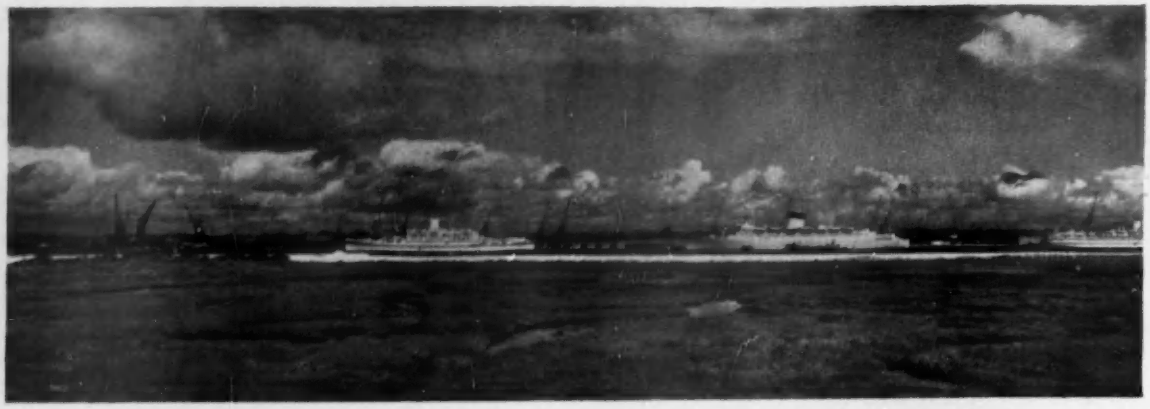


Fig. 4. The site of Marchwood (marginal land, saltings and mud on the west shore of Southampton Water)

At the present time it takes about four years' work on site to build a power station, and in consequence where estimates in the tables are in "firm" category, work will have begun in developing the main design details. Thus it is that sites must be available for a period of about ten years ahead. The finding of these sites is the responsibility of the divisions, who are each expected to have in mind or under active consideration some ten to fifteen potential sites to cater for the demand which may arise some ten to fifteen years hence. The problem of site selection will however be dealt with later.

After receiving the Authority's approval of levels of the total new plant capacity required, the Engineering Department next assesses the optimum allocation of this aggregate capacity between the thirteen divisions, according to their estimated individual requirements. In the light of the decision taken to build the supergrid system as a means of providing adequate inter-connection capacity, detailed cost investigations showed that a measure of bulk transmission is economically possible by relatively minor extensions to the 275 kV system. In deciding the broad allocation of new plant, therefore, regard is paid to the essential minimum requirements of those areas remote from the coalfields, but for the time being efforts are made to locate the remainder of the plant in the areas of cheaper generation near the coalfields, until a satisfactory level of bulk transfer has been built up.

Engineering Meetings

In the autumn of 1954 (reverting to the chronology of the programme for 1960, 1961 and 1962) a small team of representatives of headquarters departments will have visited the divisions to discuss the national plan of development, available sites, the plant programmes in relation to these sites and other relevant matters. Technical points which will have been discussed at these meetings include the provision of adequate transmission facilities and fuel supplies, while amenity considerations and local opinion are not overlooked. A major matter of investigation lies in the alternative means of installing the proposed plant, either by the building of new stations or the extension or rebuilding of existing ones.

The next stage will be a series of purely engineering meetings held in December in London at which the various sections concerned having considered the relevant factors, put forward their recommended proposals to the Chief Engineer and discuss any alternative methods of dealing with the prospective loading. Agreement will be then reached on the station and plant proposals for 1960, and if necessary adjustment made of the 1961 proposals drafted in 1953 as a tentative programme and now regarded as provisional. The 1962 figure is entered as tentative in readiness for consideration in the next yearly cycle. The recommendations after final reference back to the divisions will be submitted to the Authority for approval in March 1955. It will be seen that in this system, each programme is surveyed three times; once as "tentative," once as "provisional" and once as "final." Thus much preliminary work will have already been done by the time the programme becomes firm.

After approval of the 1960, 1961 and 1962 programmes in March 1955, work begins at once on the implementation of the 1960 final programme. Letters are sent to divisional controllers outlining the broad proposals as they affect each individual division. After further consideration in detail the division will forward in March to the headquarters a request for permission to proceed, and by April the main details of boiler and set sizes should be available. There for the present the procedure will be left. There will be occasion to go into it again in more detail when the process of establishing set sizes, obtaining consents and progressing the manufacture of plant and the building work is discussed.

Sites

The factors affecting the choice of site are varied. Today most of the best sites are already occupied and the search for new ones is becoming more and more difficult. Traditionally the most important single factor in site selection is the provision of circulating water. It is of course desirable that full cooling water requirements should be taken from river or sea, but with the powers that River Boards now possess they are able to impose conditions of flow and temperature that often make necessary the provision of auxiliary cooling towers. As pointed out by Mr Peattie recently, the stage is now being reached when the natural flow of British rivers is becoming inadequate, and coastal sites as alternatives are not as easy to find as might be imagined.

With the high cost of freight, facilities for handling the cheaper water-borne coal become essential for a modern large power station burning perhaps 4,250 tons a day. Alternatively, the station may be situated near to a colliery so that a direct supply can be provided (a method adopted at Bold "A" and "B"), or at the most a short rail haul. This desirability of siting close to the fuel supply has led to the considerable B.E.A. building programme near the inland coalfields of the Midlands and Yorkshire whence the 275 kV lines (ultimately to operate at 380 kV) now under construction, will enable supply to be given to the areas where the freight charges are high. While it is normally a principle that the more efficient station should

be located where coal is dearest, with the availability of adequate transmission capacity the converse applies since it permits of bulk generation in the cheapest area.

The load bearing ability of the subsoil has perhaps less significance in site choice than formerly owing to the advance in civil engineering techniques, none the less an unsatisfactory situation will add to the capital cost of the station. Means of ash disposal is a major factor to be considered and in some cases such extreme measures as dumping at sea by barges has to be adopted. Finally consideration must be given to amenity values and the extent to which local opposition may be raised when the formalities of planning consents have to be met.

Thus the divisions have a difficult task in maintaining a stock of potentially suitable sites which can fit in with the varied requirements of the plant programme, operational efficiency, fuel supplies and local amenities.

The next article in these series will consider the factors involved in the selection of sites, the obtaining of consents, determination of set sizes and general co-ordination.

Productivity in Copper Works

REPORT REVIEWS RECENT ADVANCES IN WROUGHT NON-FERROUS METALS INDUSTRY

EFFICIENCY of production in the non-ferrous industry is of direct interest to electrical manufacturers, who purchase much of the product. Recent advances in this field, with special reference to the wrought section are reviewed in the latest publication of the British Productivity Committee under the title "Shaping the Future," and there is more general interest in the remarks of the report on incentive schemes and maintenance.

In a survey of the background to productivity problems in the industry, emphasis is laid on the shortages that have occurred in the main materials and the sharp fluctuations in cost with a predominant rising trend. In the result, users have been driven to seek substitutes elsewhere, and it is reckoned that aluminium and non-metallic materials have supplemented 10 to 15% of current European non-ferrous production.

One of the biggest deterrents to increased productivity in the industry as a whole is the variety of its products. It is estimated in the report that even the largest and most progressive firms, which consider themselves as essentially standard-product mills, seldom produce more than half their output in standard dimensions and alloys. No generally acceptable solution to this problem seems to exist.

Costing information, so valuable in production planning, is expensive to obtain in the non-ferrous metals industry. In consequence, accurate information on the true relative costs and profit margins of various products is often not available to factory managements. The main costing problem of the industry arises from the variety of its products.

Amongst its use of most of the normal aids to productivity the industry has been giving increased attention to work study and to incentive schemes. In particular, several firms have tackled the difficult but important problem of providing incentives for maintenance engineers and other tradesmen. The crux of the problem is to ensure that the quality of maintenance work does not fall as a result of introducing incentives. Amongst the approaches adopted is arranging that the rate of bonus for time saved drops sharply after a period judged as the minimum necessary for quality work has been reached. In another firm no restriction is placed on the speed of work, but a penalty system operates, under which no bonus is payable for time spent in repairing breakdowns of plant. It is obvious that any such system can only work where an effective planned maintenance scheme is in operation.

In terms of workshop technique, the industry has made use of higher powered furnaces in casting shops, and the use of water-cooled moulds is increasing. In extrusion, rolling and wire-drawing processes, the greatest advances are considered to have been in the handling of metal between operations, either by roller conveyor or by "the power trucks which are becoming ubiquitous in the industry." The welding of coils for the speedier feeding of rolling mills is now common. Tube drawing departments are described as having undergone the greatest changes in recent years, with much conversion to semi-automatic working. Batch-type annealing furnaces have been increasingly replaced by continuous models and by the installation of continuous pickling plants.

Case Studies and Maintenance

The report concludes with case studies in a selection of firms, only a few of these can be noted here. The Prescot works of British Insulated Callender's Cables is one. It is noted that the introduction of mechanisation has been the policy of this company for years, and is very actively pursued. An example of speeding production is the use of loops and repeaters in the roughing and intermediate phases in the rod rolling mill, which has resulted in a reduction to 90 seconds in the time cycle, from rod to finished bar. To give flexibility to internal transport, mechanical horses with trailers and electric bogies are employed, and a system of short-wave radio communication exists between the vehicles and transport headquarters.

At Enfield Rolling Mills Ltd., handling in the rod mill is almost completely automatic. Brass and copper sheets are continuously annealed, some in electric Bell furnaces. The company is stated to have pioneered, in this country, argon arc welding for building-up strip. Transport is mainly by overhead crane and by electric fork-lift trucks. Maintenance men are paid a production bonus based on hours worked, with a penalty on the time machines which are idle through breakdown.

At the Winfields Rolling Mills Ltd., Birmingham, a small firm employing some 100 workers, preventive maintenance is again in operation, periodic overhauls being undertaken of all equipment vulnerable to breakdown. There is a less usual backing-up service. Under an insurance scheme, electrical apparatus is inspected quarterly by an outside examiner.

Finally, some of the remarks concerning the Yorkshire Copper Works, Ltd., (one of the biggest non-ferrous tube specialists in the world) may be noted. Electric and diesel trucks supplement overhead cranes for internal transport. Preventive maintenance is in operation, the maintenance department basing its plans on figures provided by work study staff in conjunction with its own estimates. Maintenance staff participate in maintenance schemes based on measured rates.

"Shaping the Future," a review of productivity in the wrought non-ferrous metals industry, is available from the B.P.C., 21 Tothill St, London, S.W.1, price 1s. 6d.

Electricity in Industry

FACTORY INSPECTOR'S REPORT SURVEYS 1953

DURING 1953, for the first time since the war, accidents reportable under the Factories Acts exceeded those in the previous year. This is revealed in the Annual Report of the Chief Inspector of Factories for the year. All in all, there were 181,637 accidents, of which 744 were fatal; corresponding figures for 1952 were 177,510 and 792. Accidents connected with the use of electricity totalled 744 against 721 in 1952. They are analysed by apparatus involved in the accompanying table. The increases are associated with a rise in the number of persons at risk.

There is always far more in this report than statistics, however, and this year the general review with which it opens is the more interesting for concentrating on electricity and the use of radiology in industry. It is stated that inspections carried out by factory inspectors during the year had left no outstanding impressions of changes in methods and materials in electrical installations. Steel conduit still took first place as a wiring system, though the use of mineral and vulcanised rubber insulated metal sheathed wiring increased. A steady increase was also apparent in the use of steel overhead busbar trunking with plug-in fuse boxes. Electronic control receives attention in a passage worthy of consideration by those who consider such equipment unreliable. "The expanding use of electronic equipment in the heavy industries is convincing evidence of its reliability, and dispels those early fears arising from the unsatisfactory experiences of the light engineering firms who pioneered industrial electronic equipment." The safety aspect of electronic equipment is considered satisfactory.

On the subject of radiology, one particular installation may be mentioned. This provides for the examination of turbine rotors and stators and water valves weighing up to 250 tons. It is necessary to examine these near their point of manufacture, and instead of the X-ray room taking the usual form of an enclosed structure at ground level, it consists of a deep radiation pit, whose floor is some 20 ft below general factory floor level. Though believed to be new to this country, such pits are in fairly common and successful use in the United States.

An application of isotopes that advanced rapidly during the year was the use of Thallium 204 static eliminators, of which some 2,200 had been installed by the end of 1953. The risk attaching to these in terms of ingestion by firemen and others in the case of fire has been investigated, and found to be negligible.

Electrical Accidents

In the section on electrical accidents, the inspector again draws attention to portable apparatus. 40% of fatal accidents and (excluding eye-flash) 35% of total accidents were caused by portable apparatus and by associated plugs, sockets, connectors and flexible cables. During the year there was a further advance in the practice of using 110 V portable tools, both in factories and on building and civil engineering contracts. It is pointed out that the action of the British Electricity Authority in insisting on the use of 110 V tools on the Authority's contracts has led many contractors to equip themselves with such tools. The inspector also speaks of a noticeable increase in the use of the high-cycle low-voltage system for portable tools. In addition to the safety aspect, the use of a squirrel cage rotor in such tools is considered to simplify maintenance and make it less costly. All who have used the system, says the report, speak in the highest terms of its efficiency.

Accidents while testing receive special attention in the electrical section of the report. They total 75, of which five were fatal. Two main classes of accidents in this category are distinguished. Most involve portable test sets, for the most part improvised test lamp outfits made up from a lampholder and two short pieces of cable. The only effective way of eliminating such unnecessary risks is to provide and maintain proper test lamp outfits.

After portable lamps in this "testing" classification come leads and terminals in test departments: people catch hold of them without remembering to switch off first. Particular care may be necessary in the servicing of radio and television sets, and some concern is expressed in the report about the smaller repair establishments in this respect. The main precaution recommended is that all testing should be carried out in earth-free areas, and that the supply to all sets under test should be from double-wound isolating transformers, separate transformers being used for each set under test if these are closely adjacent.

Where accidents did occur, artificial respiration was applied successfully in 18 cases and 20 unsuccessful cases are known. Of the successful cases, half were revived within 10 minutes. Fourteen of the successful cases and 13 of the unsuccessful were accidents occurring at voltages up to 250. Mention is made in the report of the fact that the Holger-Nielsen method of artificial respiration is now well established, and that appropriate electric shock placards are available. Increasing acceptance of the Eve rocking stretcher method is noted. It is remarked that where suitable stretchers are kept at hand or can be improvised by trained personnel, some authorities recommend that an electric shock victim should be treated immediately by the Holger-Nielsen or Schaefer method. and then transferred to the rocking stretcher as soon as it has been brought alongside, or can be made up.

Reportable Electrical Accidents: Analysis by Apparatus

Apparatus	Fatal		Non-Fatal		Total
	Men	Women	Men	Women	
Portable apparatus:					
Portable electric machines	6	—	43	3	52
Portable heaters and irons	—	—	4	5	9
Portable lamps	2	—	14	—	16
Portable test sets including lamps	2	—	35	—	37
Plugs and adaptors	2	—	23	4	29
Cables and flex for portables	3	—	25	4	32
Electric hand welding:					
(a) Shock and/or burns	1	—	27	1	29
(b) Eye injuries	—	—	162		162
Fixed apparatus:					
Electrical machinery	—	—	11	—	11
Transformers	3	—	3	1	7
Switchgear above 650 V	4	—	34	—	38
Switchgear below 650 V	4	—	107	4	115
Fusegear	—	—	32	—	32
Crane trolleys	2	—	34	—	36
Fixed lamps	1	—	14	3	18
Cables for fixed apparatus	2	—	45	1	48
Test leads	1	1	12	4	18
Apparatus not classified	6	—	47	2	55
Total	39	1	510	32	744
			Plus 162 eye-flash accidents (welding)		

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Preventing Lamp Pilfering

THE letter on lamp losses on your "Problems and Practice" page in the 30th December issue I found most interesting. Like your contributor, I do not favour the use of lamp-locks, not only by reason of their inconvenience, but because in many cases the metalwork of the lock will "set-up" and be a source of trouble. The use of E.S. lampholders to prevent pilfering has, of course, occurred to us before, and the suggestion drew forth the rejoinder that "Once the new policy is common knowledge, lamps *and* lampholders will disappear, and our E.S. lamps will be used exclusively." However, be that as it may, the idea of adapting shades to suit E.S. lampholders has precipitated my asking a question I have been minded to ask before; why is it not possible to obtain a shade with hole big enough to accommodate an E.S. holder? Surely such a need must have been felt by others than myself? Of course, such shades may by now exist; but if they do, I have so far been unable to run them to earth (Manufacturers please note).

My last words in parenthesis prompt me to suggest that a *Desiderata* feature might profitably be accommodated in the ELECTRICAL TIMES. Not all suggestions appearing might be taken up by manufacturers, but without doubt a great number of readers would benefit.

L. Giltrow,
TWICKENHAM.

Economics of Hydro Power

IN common with so many of your readers, I have read with the greatest interest the article in your current issue on the plans for North Wales Hydro-Power.

A number of thoughts occur to the Power Station Engineer, e.g. what proportion of the units generated per annum will be produced from natural make-up water as distinct from water which has been re-circulated from the bottom to the upper reservoir? What is the overall efficiency of the cycle e.g. of a unit generated at, say, Clarence Dock, Liverpool, transmitted back to Ffestiniog, used for pumping up the top reservoir, and then returned back to Liverpool as a re-generated hydro-produced kWh?

From the pure standpoint of national fuel conservation, such a cycle of operations seems to have little to offer. The main advantage of the scheme would appear to lie in the peak kW contribution at a comparatively low capital charge. Where civil engineering works are relatively inexpensive, as would appear to be the case in the Ffestiniog scheme, the saving on a comparative steam station by the elimination of such items as boilers, coal and ash handling plant, chimneys etc., and the simplification of the prime mover must be great. Whether the saving in maintenance costs would be as real as they are at first sight apparent is perhaps questionable. The increased load factor on the steam stations in order to provide the off-peak pumping units must of necessity increase wear and tear on boilers, etc., and certainly increase the B.E.A.'s difficulty in finding time to complete their annual maintenance programme.

To sum up, the unit produced from such a pump storage scheme would appear to be very expensive. The kW is likely to be very cheap. To what extent does the comparison indicate economic advantage over the life of the plant? It is, alas, now some years since my modest talents were diverted from the fascinating field of generation operation and economics and much that I write may therefore be misinformed or out of date. But this bold B.E.A. project is so interesting that more detailed information would, I think, be welcomed by engineers.

H. Pryce-Jones, M.ENG., M.I.C.E.,
BRIGHTON.

Appointments from Outside

MR H. J. RANDALL expresses his contempt for "J.T.'s" action in writing anonymously about L.E.B.'s recent appointment of a new Secretary.

I have no axe to grind either directly or indirectly, neither have I any quarrel with Mr Randall's explanation of the situation, but I must remind him that reputable papers like the ELECTRICAL TIMES recognise that some subjects can only be dealt with under pseudonyms.

From his letter I infer that "J.T." is in the Supply Industry. He may even be on Mr Randall's staff. Does Mr Randall think "J.T." should have been foolhardy enough to write under his own name? I consider that the Editor properly exercised his discretion by allowing "J.T." to raise a matter of public interest under a pseudonym.

"J. T. Squared."
SURREY.

* * *

WHILST I fully agree and sympathise with "J.T." as regards his views with reference to this matter, I would point out much worse treatment has been meted out to some of the senior and junior officials of the pre-vesting days in Electricity Supply Industry.

Others besides myself, with many years of good, and if I may say honourable service, have been thrown on the scrap heap to make room for newcomers with no experience in the industry. In many instances, these newcomers had no supply experience whatsoever and no recognised qualification other than those of a political partisan. This point can be easily proved by reference to the *Electrical Times Handbooks.*

As I do not wish to experience any further victimisation, I sign myself

"Truth."

Fluid-Filled Radiators

OBVIOUSLY, as Mr A. W. Bates states, there are applications of all methods of heating in domestic premises but I feel he is making a sweeping statement when he says that "The proof of the pudding is 3 years entirely satisfactory radiant heating of living rooms with heat cheaper."

How can Mr Bates state this unless he has carried out a proper test using one type of heating in one room, with another type of heating in another room of exactly the same size, same standard of insulation and during the same degree days?

Of course we all have our pet theories as to what is best for this and that but the complete answer should be a proper test. I shall be delighted to loan my radiators to any person or organisation to carry out a proper test over a reasonable period of time under identical conditions.

My view is that I think the success of the oil filled radiator proves to some extent my point that oil filled radiators, under proper thermostatic control, are much cheaper in the long run than electric fires.

Finally, with regard to the emission of radiation and

convection from a radiant fire, the proportion of radiation to convection varies according to the temperature of the heat source and I do not think there is any shadow of doubt that as the panel radiator produces a higher proportion of convection to radiation, it is much more suitable for continuous heating, and of course especially for background heating which is the main purpose for which oil filled electric radiators were designed.

I would emphasise that in an earlier letter, I made the point that topping up would always be required by a radiant heat source appliance, be it electric, gas, or free standing open fire with restricted throat, if the occupant of the room wished to sit down and relax.

A. C. Hazel,
Managing Director, HURSEAL LTD.,
LONDON, W.1.

Advantages of Electricity

THE article under the above title in the Christmas number was interesting and instructive but obscures the fact that the municipal "pioneers" in Whitechapel were well behind some of the other districts in London. The letter included in my article which you were good enough to publish in your Christmas number of 1950 did not promise a possible supply before Christmas, as does the "sales letter" of Whitechapel in 1899, but states that "we are prepared to connect and supply current within a few days after receipt of instructions" and the date of that letter, though not given in the article, is February 1893—6 years earlier—and, moreover, it refers to the terms of "other Supply Companies." Some consumers had the "advantages of electricity," and a choice of supplies long before 1899.

The *Financial News* of 24th October, 1888 said "London already possesses the largest electric lighting installation of its kind in the world." They referred to the enterprises of those bold spirits some of whom had even jumped the starting gun of the 1882 Act.

E. H. Jesty, A.M.I.E.E.,
BROMLEY, KENT.

P. F. Correction

IT gave me great pleasure to read Mr. Solt's article on power factor correction. It is the most lucid and comprehensive treatise on this intricate subject that I have ever read.

But why did he spoil it, at least for me, by including the almost inevitable recommendation to go to the B.E.A. for advice? It is true that the Boards have facilities for giving "advice to consumers on ways of dealing with such problems." Yes, and so has every electrical contractor who knows his job. Any industrial consumer who is interested in power factor correction need go no further than the electrical contractor who does his electrical work, and certainly no further than the local E.C.A. member.

It is fair to say that the Boards themselves do not encourage this "go to the B.E.A. first" attitude. They are usually most helpful to the private contractor who has a P.F. correction job on his hands, as I know from experience.

W. A. Gazard, A.M.I.E.E.,
BIRMINGHAM, 33.

Self-Regulated Alternators

MAY I compliment the author for the paper on "Self-Regulating Alternators"—Part 1, in the issue dated 2nd December.

There is a small point which I would like to mention regarding figure 5. The triple pole series contactor is shown in the excited (operating) condition. In this condition the contactor coil is energised and has therefore opened the contacts. The moving contact is thus normally shown on the other side of the fixed contacts to that given in the diagram.

G. E. B. White.
LONDON, N.W.3.

Physiology and Heat

IT seems to me that your correspondent "Thermo-electric" confuses the issue when he states that "The human body has, fundamentally, an optimum temperature for heat intake and the whole object of heating systems is to provide the maximum amount of B.Th.U.'s available at this temperature."

It is surely very widely appreciated today that the object of space heating is not to add heat to the human body, which is at a temperature considerably higher than the normal room temperature of 65° F, but to control the loss of heat from the body.

The only person who can say whether he is comfortable or not is that person himself. Different people have very widely varying ideas of what constitutes comfort but I think it is true to say that a very large number of people find a reasonable amount of high temperature radiation, accompanied by a moderate air temperature, very agreeable.

"Thermo-electric" might reflect that nature's way of providing comfort is by very high temperature radiation at a moderate air temperature.

E. M. Ackery,
LONDON, W.C.2.

Hospital Installations

I AM greatly interested in the article by Megohm in the 16th December issue of the ELECTRICAL TIMES and am rather amazed that he advocates the use of bed light fittings costing £7 each. I think very few hospitals would allow an expenditure of this order.

I am of the opinion that it is quite useless putting forward any bed light fitting costing more than about £3 for use in hospitals.

It should be possible to design a bed light fitting with a swinging arm which will allow beds to be moved up closer together and the odd bed, which is being pushed in, can have a bed light on the locker.

A. D. G. Isherwood,
BELFAST, N. IRELAND.

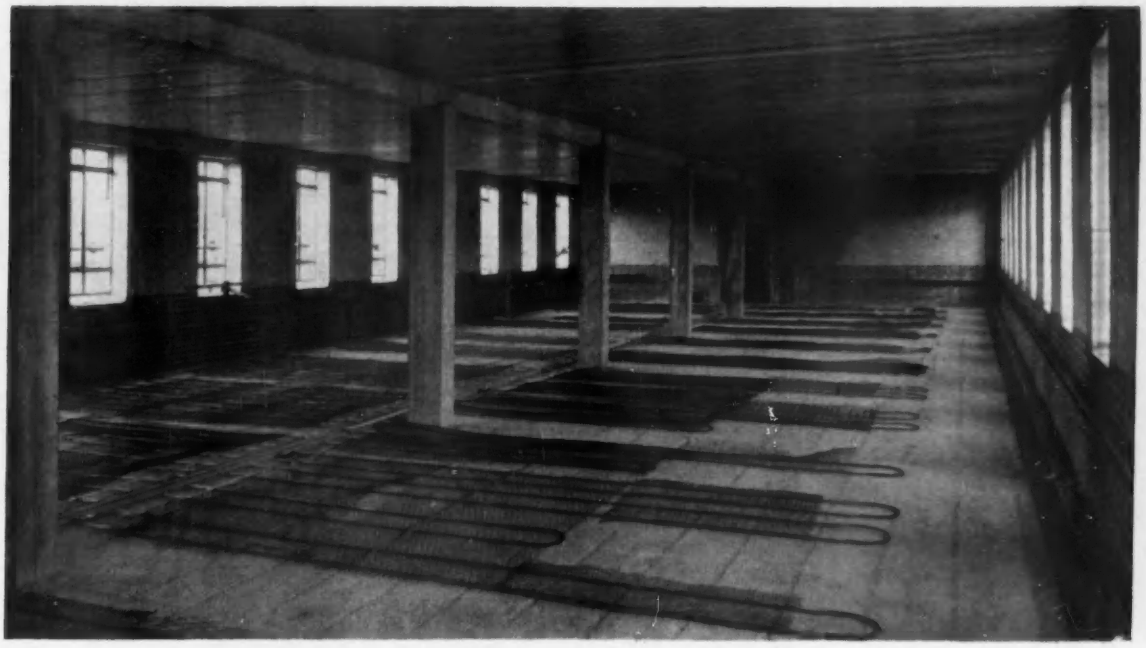
Contact Cleaning

RECENTLY I was called upon to repair a 10 kVA 3-phase heater fan, the fan motor being a fractional h.p. machine operated jointly with the heater elements through a thermostatically controlled contactor.

This heater was looped off the live side of a triple-pole 45-amp switch-fuse which also controlled a welding plant. The welder informed me that the heater fan would start up as soon as he began welding. On checking the switch-fuse I found that one of the fixed and moving contacts had burnt out and that the solenoid of the heater contactor would not operate until the heavy current taken by the welding plant broke down the resistance of the burnt-out contact. After fitting a new fixed and moving contact both welding plant and heater fan operated satisfactorily for a few weeks, but the trouble soon recurred.

Luckily by this time I had read Mr J. E. Hooper's excellent note on oxidisation of copper contacts. (Reader's Views, 16th December). On re-examination of the switch-fuse I found that all the contacts were indeed oxidised which made me resolve that in future all switchgear will get an annual smear of mineral jelly.

A. G. Sewell,
KIDDERMINSTER.



Electric Floor Warming

DESIGN INSTALLATION AND CONTROL OF DUCTED SYSTEMS OPERATING DURING OFF-PEAK HOURS

SPACE heating effected by warming the floor of the building has been in use since pre-Roman times and where the original method involved circulating hot air in ducts beneath the floors, more modern versions employ coils of piping embedded in the floor, through which hot water is circulated. With the advent of electricity however, it became possible to replace the hot water by a fuel which permits closer control to be exercised over the system using comparatively cheap and inexpensive instruments. Of the electrical systems available, those employing heating cables run in ducts laid in a cement screeding have a number of advantages over other methods, and are suitable for solid concrete, precast concrete, beam, hollowpot, or any other type of floor requiring a screed before finishing. It is the purpose of this article to describe such a system in greater detail, with particular reference to that supplied by Panelec (Great Britain) Ltd.

Why should electrical floor warming be adopted in preference to any other method of space heating? In most cases the adoption of any one system is dictated solely by installation and running costs and it is on this basis that the electrical system competes, bearing in mind that the heated floor transmits the major part of its heat energy by radiation. Any heating system employing a heated surface has of necessity to transmit from the surface sufficient energy to maintain comfort. The temperature difference between the heating surface and its surroundings, however, depends on the appliance, hot water radiators, for example, usually operating at a mean temperature of 160° F against 75° F for a floor warming system, with a room temperature of say, 60° to 64° F in each case. For the two systems to transmit heat at the same rate, it follows that the floor warming system requires some six times the area of heated surface than the hot water radiator, as its difference in surface temperature with the surroundings is only one sixth of that of the radiator.

Low surface temperature—only 7 to 13° F higher than the mean room temperature—with large transmitting areas, is thus one of the bases of the system, the other two important factors being radiant transmission and origination of warmth in the lowest level in the space. All combine to impart a pervading warmth, with no hot or cold spots. Moreover, an inverse temperature gradient results, with the air temperature higher below the breathing line than above, as against convection systems where the upper air temperature may be as much as 10° F above that at the breathing line. This is a particularly valuable feature for heating large structures like aircraft hangars. Another important advantage of the floor warming system is that by utilising the building fabric for heat transmission, it is entirely concealed. With the exception of room thermostats, accommodation space does not require to be allocated, giving complete freedom of building design, as depicted in Fig. 8. Distribution gear can usually be positioned in suitable positions out of the main space.

Off-Peak Operation

From the viewpoint of electricity supply authorities the system is particularly advantageous. Buildings of normal construction usually achieve a sufficiently high thermal storage capacity to allow the heating intake to be restricted to off-peak periods. Not only is this of considerable importance in raising the load factor, but it allows the consumer to take advantage of more favourable tariffs offered for this type of load. Off-peak operation, however, depends entirely on the thermal storage capacity of the

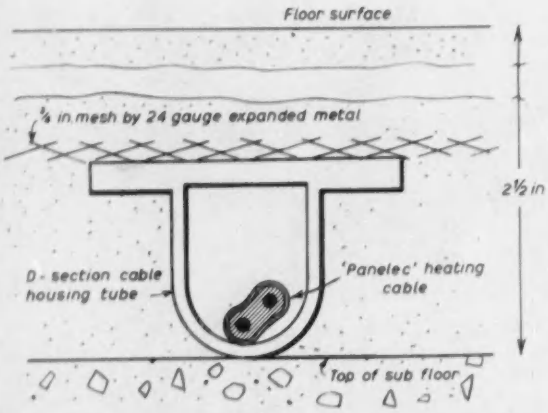


Fig. 1 Cross section of cable and its "D" section housing when finally installed and screeded over

building and each site must be considered on its merits.

Three methods are available for floor warming, embedding bare wires directly in the floor for e.l.v. supplies; embedding insulated metal sheathed cables directly in the floor for operation on mains voltage, and laying insulated cables, operating at mains voltage, in conduits embedded in the floor. "Panelec" is of the latter type, and, consequently, is fully rewireable. On the event of a fault, any heating or supply cable may be removed.

Although the use of tubing arose originally from the desire to ensure rewirability of the system, it has since been found that its use resulted in greater upward heat transmission than that obtained with directly embedded cables. Of the types of tubing tested, the present "D" section proved to be the most efficient, further improvement being gained by placing a sheet of expanded metal over the tubing, to smooth out the temperature gradient between adjacent runs (Fig. 1).

Laying the heating cable in a tube reduces the surface area of the cable in contact with the surrounding floor mass and consequently lessens heat conducted sideways and downwards through the floor, which is wasted energy. Inside the tube, the cable has probably only some 10% of its surface in contact with the walls of the tube, heat transfer to the tube being effected by a combination of convection and radiation. Due to the shape of the tubing the heat is diffused over surfaces directing mainly upwards toward the layer of expanded metal.

Design of floor warming systems

The calculation of heat losses is the first step in the design of a heating system, and, in the absence of more information on the difference in heat loss through building fabric for radiant heating systems, calculations are, at present, based on straightforward conventional methods. Thus, the "U" values taken for walls, roofs, windows and other surfaces through which heat losses are likely to occur are taken from the handbooks made available from the various authoritative sources. This procedure ignores the fact that, with radiant heating, surfaces through which losses occur stand at appreciably higher temperatures than with convection heating, and therefore the difference in temperatures between internal and external surfaces being greater, the rate of loss should be increased. Results, however, justify the practice of ignoring this factor.

Although the total heat loss from a given space, when calculated, determines the total transmission rate from the floor required to maintain comfort, the limitation of floor temperature to a given value necessitates expressing this loss as a mean energy transmission rate per sq ft of transmitting surface area. This figure, when measured against the total floor area available for transmission, then makes it apparent whether the floor area is sufficient to provide the total transmission rate without exceeding the working temperature limit, as in this case, of 75° F. If insufficient surface is available, the balance of heat transmission must be supplied by other means (such as embedded wall panels) or heat losses reduced.

Table 1. Surface Temperatures recorded with a "Panelec" floor warming system

Location	Temperature °F for an external air temperature of 38 °F					
	Floor surface	Inside face of external wall	Desk	Lighting fittings	Partition walls	Internal air
Room 1	73	63	72	69	70	67
Room 2	71	62	68	67	69	65
Room 3	72	63	67	66	69	68
Room 4	72	65	67	66	69	63
Room 5	75	69	73	67	71	68
Room 6	75	68	71	68	71	68

In a room in which the air temperature and the mean radiant temperature—the mean temperature of all unheated surfaces—is 62° F (a conventional assumption), the energy transmission rate from a floor of surface temperature 75° F is 30 to 34 B.Th.U./sq ft of floor area, and a rate of transmission above this must be associated with either a higher floor temperature, or lower mean radiant and air temperature. Although 75° F is the generally agreed limit for floor temperatures, in practice it is often found that 80° F brings forth no comment, whilst 85° F is appreciated rather than disliked. Since the transmission rate from a floor varies within a room itself due to local variations in the temperature of unheated surfaces, the floor loading is

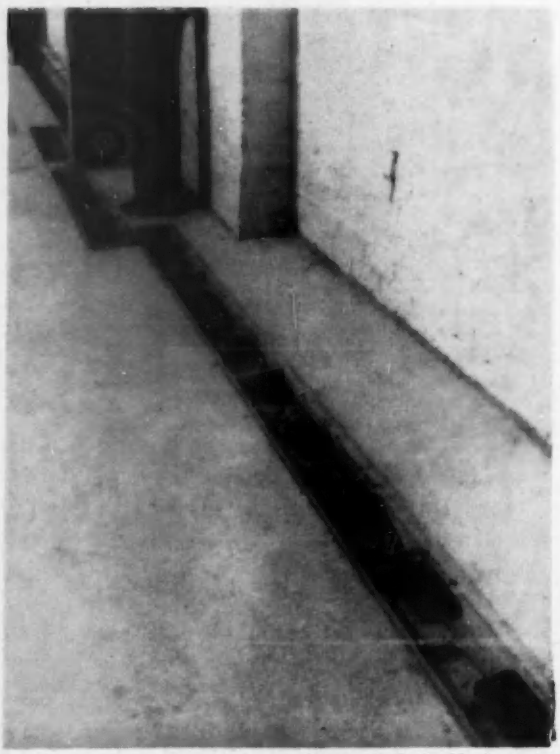


Fig. 2 Floorheating installation at Messrs A. F. Stoddards carpet factory, Elderslie, showing the heating cables drawn into conduits and special sealing boxes together with the bonding wires

often increased in the vicinity of windows where a higher transmission rate, due to the lower surface temperature of the glass, may be tolerated. Table 1 gives some indication of the surface temperatures to be expected.

Multi-storey Buildings

Multi-storey buildings present a somewhat different problem as the heat input to intermediate floors is transmitted upwards and downwards. The top floor, as always, presents greatest difficulty, since not only must the design provide for a greater rate of heat loss through the roof, but some of the available heat will be transmitted downwards. In a two storey building, for example, the first floor heating load would be calculated as for a single storey building, making suitable allowance for edge loss to obtain

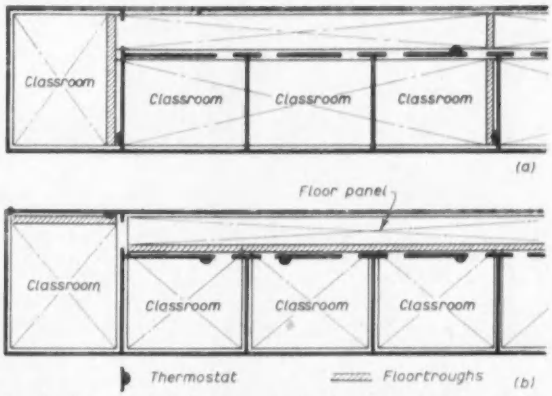


Fig. 3. The method of designing a system to cover a given zone of flooy area with a heating panel to incorporate a number of rooms and in conr trast (b) the alternative method in which each room is treated individuall-

the necessary transmission rate upwards. The heating requirements of the ground floor are then calculated, and the value, less the transmission rate from the ceiling due to the first floor installation, gives the transmission rate required from the ground floor system.

Having established the transmission rate for the building to be heated, the design of the installation itself may be considered in greater detail. Buildings of size are best approached by dividing them into a number of distribution areas, locating, if possible, a suitably small space for siting local distribution and fuse boards. Next in order of consideration is the positioning of floor troughs, those to be used for supplying cables being placed nearest the centre of distribution. At this point, the various lengths of heating cable available are taken into account.

Trough Positions

As a general rule, troughs are positioned at the foot of transverse walls, secondary rooms being used as much as possible. On the other hand, if each room is to be independently controlled with its own thermostat, it may be more convenient to run the troughs along the entire length of a corridor, enabling heating cables to be taken transversely into each room, as shown in Fig. 3. This diagram also illustrates the method of providing panels to heat a given zone of several rooms. It is seen that the end room, having a greater loss surface and therefore requiring a greater heat input, is treated independently. Were it to be included in the zone heating panel, then the floor loading would be based on the intermediate rooms, and the end room "boosted."

On determining positions of floor troughs, and the lengths of heating cable required, it is then necessary to

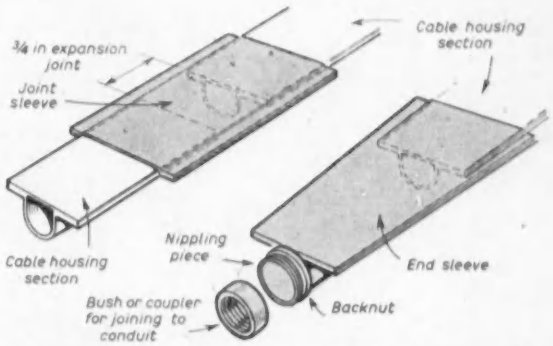


Fig. 4. Joint (left) and end sleeves for extending and terminating cable housing sections. Note that in both cases the fit leaves room for expansion. The coupler on the end sleeve is designed for fixing to both ½ in. conduit or cable trunking

determine the number of cable runs in a given space. Reference to heat loss calculations for the space to be heated will indicate the total heating load required, and this value, divided by the load in one cable run through the space, provides the number of runs required. Where a zone panel is serving a number of small rooms, requiring a number of runs between respective troughs, the heating load has to be checked for all rooms concerned. When the load/run calculation is based on the linear load of the cable, care should be taken to see that only when the cable is laid in position in the "D" tubing should its length be measured and that the cable is not exhausted before reaching the second floor trough. Spacing between runs is decided by fixing the two outer runs, and dividing the space between them equally.

Thermostats are positioned with reference to wiring involved, to minimise cost. Usually they are placed in the wall above the trough carrying the supply wiring to the floor panel to be controlled. As large numbers of thermostats do not improve control, except where large temperature differences are planned, 15 amp relays are employed to keep the number to a minimum. In certain cases, a single thermostat may be used to control several relays placed on the outgoing side of the dis-board, or even a single contactor on the incoming circuit.

Installing the heating system

Installation itself commences in marking out the positions of floor troughs. These will eventually hold the cable trunking to which the cable housing sections are fixed. Housing sections are then laid in position on the structural or sub floor to the centres specified in the design. Sections, which, together with their associated fittings are fabricated from aluminium, are supplied in nominal 10 and 15 ft lengths, complete with screws and washers for securing the expanded metal sheet. Longer runs may be built up by joining successive lengths with special joint sleeves. Of the slide fit pattern (as shown in Fig. 4) these effect a full through connection between adjacent sections but ¼ in. clearance should be left between two sections so connected to allow for thermal expansion.

Other cable housing fittings to be attached at this stage are end sleeves, which provide a means of terminating the tubing at trunking or at a joint with ⅝ in. conduit. Like joint sleeves they are a sliding fit over the "D" tube, the other end tapering to a screwed nipple which enables a fixing with backnut and bush to be effected to trunking. Although cable is run between troughs on most occasions, conduit bends are used to link pairs of housing sections in situations (near showers, sinks or similar places) where floor troughs are precluded due to the possibility of

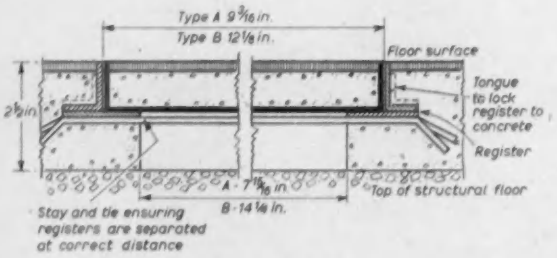

Type A 9 3/16 in.
Type B 12 1/8 in.
Floor surface
Tongue to lock register to concrete
Register
2½ in.
A - 7 1/16 in.
B - 14 1/8 in.
Top of structural floor
Stay and tie ensuring registers are separated at correct distance

Fig. 5. Section through a floor trough showing the trough cover in position located on each side with its registers

moisture ingress. In small spaces they have the further advantage of making available as heating surface the maximum floor area. Bends are fabricated to the required radius on site, using ⅝ in. h.g.s.w. conduit. Connection is made to end sleeves by coupling pieces. Since their use limits access to the floor panel at one end only, draw wires must be inserted into the cable housing sections and conduit bends whilst they are being laid. Heating cables would be then drawn in from the access trough along the first section, round the conduit bend and back into the trough through the second section. A second draw wire should be drawn in with the heating cable.

After inserting draw wires in the laid out sections, jig bars are fitted across the runs of tubing to maintain correct spacing between them. Two types of jig bar are available, the horizontal type which is laid flat across the tops of the parallel runs of sections, or the vertical type which, used in conjunction with end sleeves, are attached to the ends of the housings. Both types are supplied ready drilled and complete with screws, and apart from maintaining correct separation they assist in ensuring electrical continuity between sections. Fitting the expanded metal sheeting then completes this phase of the installation.

At this stage, attention is given to the floor troughs. Initially the builder builds up suitable shuttering to form the troughs, after which the contractor places in position registers for the trough covers. Shown in end view in Fig. 5, registers are a composite assembly in 10 gauge steel supplied in lengths up to 7 ft ready for use. Basically, they comprise two inverted T pieces (formed by attaching angle section to flat strip) separated at intervals by a tie bar which projects from each side in tongues to ensure a secure hold in the cement screed. The trough cover sits on the inner horizontal bar of the inverted T, between the two upright bars, which also have tongues projecting outward at intervals to provide for greater holding strength in the screed. Trough covers are of the removable recessed type, in 16 gauge steel, and 2 ft 3 in. in length. They are filled by the builder with the appropriate floor finish, design providing for 1 in. wood blocks where used. During the preparatory work, covers should be laid upside down in their registers.

Before commencing with screeding proper, a benching of fairly dry screed is applied round all joints and end sleeves and allowed to set, to prevent slurry entering the cable housing sections. During screeding itself, scaffold board bridging or similar supports should be employed if it is necessary to transport screed in wheelbarrows across areas on which tubing has already been laid. Immediately after screeding, draw wires are tested to ascertain whether or not slurry has entered housing sections. It is, of course, necessary to clear any slurry which may have entered before it sets. The floor is then finished up to the required level.

Heating cables, which are now drawn in, comprise a cupro-nickel conductor embedded in mineral insulation and enclosed in a lead alloy sheath. Although of twin formation when seen in cross section, the cables contain only one conductor, which is doubled back on itself prior to sheathing. Connections therefore are made at one end only, the other end being blind. Supplied in standard length and loading, they should on no account be shortened below the dimensions specified in the loading schedule applicable

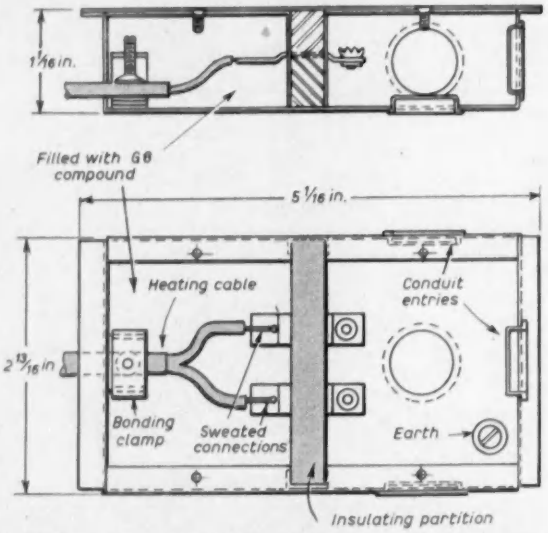
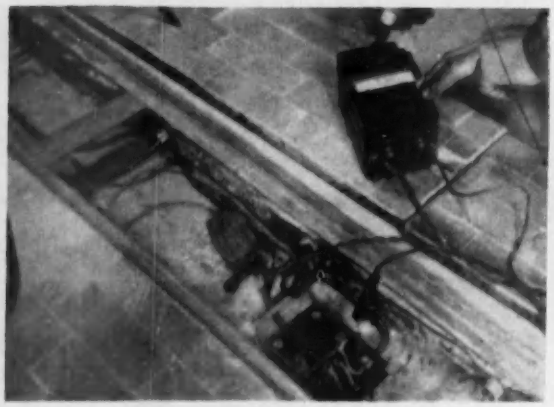


Fig. 7. Plan and cross sectional view of the specially designed terminal box provided for the system. It is divided into two separate compartments to allow the heating cable connection to be isolated

Fig. 6. Testing "Panelec" heating cables prior to making final connection



to the scheme without reference beforehand to the supplier. Before dispatch, they are tested at 1 kV for one minute, and for indication, they bear a label distinguishing between connecting and "blind" ends and stating standard length and loading. During the drawing in operation, the undue strain on the sheath should be avoided, and a draw sock attached to the end which eventually will be stripped for connecting up.

Cables having been drawn in, connections are then made in the terminal box supplied. Made from aluminium (Fig. 7) it is specially constructed in two sections divided by an insulated partition to enable one half to be completely filled with sealing compound. In this half the cable is connected by securing the sheath to the bounding clamp and soldering the conductors to the terminals fitted in the

Fig. 8 Silence Room, Constance Hall, Lincoln, heated by "Panelec" embedded floor covering, illustrates the complete freedom of design and unencumbered floor space imparted by this method of space heating

partition. Suitable terminals are fitted in the other section for securing the supply cable, and a selection of conduit knockouts is provided. The installation of floor panels is then completed by fitting the trough covers which the builder will have filled with the appropriate floor finish, and carrying out the usual electrical tests.

The "Panelec" system provides for an entire installation, distribution gear and thermostats are also supplied. The latter, being specially designed for this system, operate principally on radiant temperature as against air temperature. For this reason, they are provided with a domed cover to prevent air movement, and, consequently, air coming into contact with the mechanism. Although the dome is not sealed, and completely radiant operation cannot be claimed, its efficiency is estimated to be as high as 90%. Contacts, which have a snap make and break operation, are rated at 20 amp a.c. or 0·1 amp d.c., whilst a range of 40° F to 80° F is covered, with a temperature differential of ± ½° F. The unit is normally supplied complete with a 4 in. circular conduit box for recessed mounting although an octagonal bakelite case can be fitted for surface mounting.

Ancillary Switchgear

Both master and local switchgear, specially designed to serve the installation, is supplied. Master gear is of the cubicle type, incorporating all necessary distributions and control equipment for the heating system it supplies and it is only necessary to provide incoming feed and outgoing circuit cables. In general, the cubicle provides, apart from the main distribution gear itself, a time clock, external anticipatory control, metering and, if necessary, distribution fuse boards for heating subcircuits, although a drawing showing equipment, its dimensions and connecting facilities is prepared for each scheme. Relays are also incorporated as required for controlling loads in excess of the thermostat's capacity, whilst main controls for lighting, small power and other requirements for the installation as a whole may also be built in.

Local distribution units incorporate isolators, fuse boards, and relays (where required), and are supplied with all interconnections made, so that, as with master gear, only incoming and outgoing wiring need be supplied and connected. Similarly, a drawing is prepared giving full information, and specifying size of circuit cables. Both surface mounting and flush mounting units are available.

In practice, the correct operation of the heating system to maintain comfort conditions involves a number of factors and, to a certain extent, how far they have been allowed for in the design. Basically, control of temperature relies on the radiant thermostat, but since one of the major advantages of the system lies in its being energised only at off-peak hours, the duration of intake and the associated thermal storage of the building have to be taken into account.

Obviously, the thermostat can only operate as a limiting device during intake hours when the system is energised, and its purpose is to ensure that when a room is due to be occupied, it has reached the specified comfort level. It may, therefore be convenient to incorporate the time switch restricting intake in the same control circuit, particularly where the thermostat controls the coil of a large contactor. Normally, thermostats are positioned at the approximate breathing line, 5 ft above floor level. At this position it offers advantages of control over thermostats mounted at floor level and measuring the floor temperature, not only in reducing installation costs, but in minimising consumption during intake.

To appreciate the difference in operation between wall and floor mounted thermostats, it must first be realised that as the rate of heat transmission from the floor is related to the temperature differential, then the floor temperature will rise and fall automatically to vary the transmission rate as heat losses vary due to changes in the external temperature. In general, an average floor varies in temperature between 71° F and 74° F during a normal heating system. For this reason it is impracticable to alter the setting of a floor thermostat to correspond with a variation in external temperature, and almost invariably floor thermostats are left permanently set at the higher

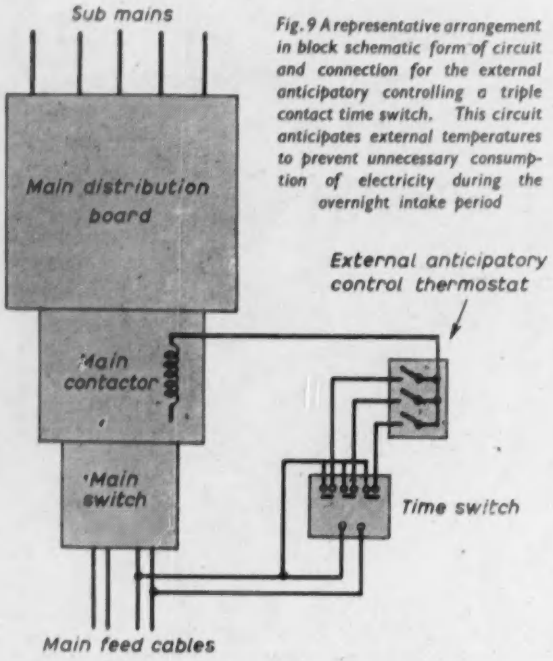


Fig. 9 A representative arrangement in block schematic form of circuit and connection for the external anticipatory controlling a triple contact time switch. This circuit anticipates external temperatures to prevent unnecessary consumption of electricity during the overnight intake period

level of 75° F, whereas wall thermostats are set to maintain the room at the lower temperature of 60° F (say).

What happens, however, during periods of no intake, if the external temperature rises or falls? Obviously thermostatic control is inoperative, and it is here that the thermal storage capacity of the building is taken into account, although the calculated thermal storage capacity of a building rarely coincides with results in practice. Heat energy stored in the average ground floor slab, (as only one component) would, it appears from such calculations, be dissipated within about 10 hours, yet there are many instances of floor temperatures being maintained for 18 hours without intake. No doubt, heat energy given up by the occupants will assist in maintaining comfort, whilst on some occasions radiant energy from the sun contributes to reducing the rate of loss.

To date, no complaint, it is stated, of fall or rise in temperature during the period of no intake has been received from a consumer. This seems to indicate that any variation of temperature is so small as to be unnoticeable. The time lag due to thermal storage, which is peculiar to this type of heating system quite clearly operates to the advantage of the consumer. From recorded measurements, the maximum fall in temperature at 7 p.m. is only 1·5 to 2° F, the rate of fall being greatest at this time, when electricity intake is resumed.

During intake hours, the heating installation must not only provide sufficient energy to counteract losses, but replenish, where necessary, the thermal storage vesssl which may have been depleted during the day. Apart from regulating temperature, therefore, the control system must satisfy these requirements without long overnight "simmering." Whilst a building is maintained at comfort level, the rate of heat loss, in relation to the prevailing external temperature, is at its maximum and hence, to minimise energy costs, this period of maximum loss should be as short as possible. A fall in internal temperature immediately after occupancy therefore enables an energy saving to be made, but the fall must be controlled to ensure that recovery can be made in the remaining hours of intake.

To provide the necessary relation between external

Table 2. Recorded consumptions for "Panelec" installations

Building	Calculated Heat Loss B.Th.U./hr.	Calculated Ave. Temp. Rise °F.	Floor Area sq. ft.	Volume of Building cu. ft.	Installed Heating Load kW	Estimated Annual Consumption kWh	Recorded Consumption kWh
1. School	1,245,000	30	41,000	506,000	375	562,000	610,000*
2. Public building	870,000	35	20,000	258,000	262	393,000	377,000
3. Workshop	975,000	32	24,000	365,000	286	468,000	461,000
4. Office block	579,000	32	15,000	185,000	172	258,000	237,000
5. School	240,000	30	9,500	94,000	72	108,000	111,000*
6. Offices	104,000	32	3,000	24,000	31	53,000	49,050
7. School	1,300,000	30	42,000	490,000	388	650,000	755,000*

temperature, intake hours and installed loading, the system incorporates an external anticipatory control comprising time switch and externally situated thermostat and since any system operating on restricted intake already employs a time switch, only the external thermostat and wiring constitutes the extra item. As shown in Fig. 9 the time switch should provide three switches as in the type GP unit supplied by Venner Ltd., whilst the thermostat provides for switching at three temperatures.

In operation, the first time switch circuit allows intake for the full time specified but if the external temperature exceeds the winter mean, this circuit is broken by the thermostat, delaying intake until circuit No. 2 is made by the time switch a given number of hours later. The second circuit, however, is broken by its own thermostat if the temperature exceeds a given limit and intake is again delayed until the third time switch circuit closes. The thermostat in this circuit is set at 55° F and at this temperature intake ceases entirely. The thermostat is of the phial type, enabling it to project through the wall, with setting dial and connections located internally.

Costs of floor warming

No discussion of a heating system such as this would be complete without mention of costs. A "Panelec" floor warming system costs between £18 and £25/kW of installed loading including builder's work, the variation arising from the wide variation in layout between buildings of the same cubic capacity, floor area and installed loading. Of this figure, between £7 and £8/kW is taken for the electrical installation, being sub-divided into £3 for installation of the heating equipment, £2. 10s. for sub-circuit wiring, conduit and associated work, and from £1. 10s. to £2. 10s. for control and distribution gear. From these figures it is seen that the main variable is the cost of the heating equipment itself, the lower figure of £11/kW applying where large open spaces are being treated, and the higher figure of £18/kW for buildings where a number of small spaces have to be treated separately. Builder's work is straightforward and probably accounts for an extra £1. 5s./kW of installed loading.

Any estimate of running costs introduces difficulties at the outset due to the wide variation in tariffs over the country. An indication can only be given by discussing consumption rates, but since the conventional methods of calculating the annual fuel requirements are grossly inaccurate for floor warming systems, consumption rates can only be established by using known figures derived from a variety of existing systems. Table 2 gives data for seven installations, and it will be seen that estimated rates correspond closely to actual rates. The greater difference between the two in buildings having their first heating season results from the new materials having higher "U" values than those used in calculations due to their high moisture content. None of the installations listed incorporates an external anticipatory control.

Large 110 kV Cable Installation

NEW 75 MVA FEEDERS LAID AT BELFAST

AN extensive reinforcement of the Belfast Corporation power system has recently been completed by the laying of two parallel feeders connecting the Belfast West power station with the Donegall substation of the Electricity Board of Northern Ireland. These feeders are respectively 6,434 and 6,184 yds long and are 110 kV, 0·3 sq in. 3-core paper-insulated, oil-filled, reinforced lead alloy sheathed, single-wire armoured and served cables, with three 19 mm diameter oil ducts contained within the spaces between the cores. They were provided and laid by W. T. Henley's Telegraph Works Co., Ltd.

For the greater part of the route which runs through the centre of the city, the feeders are laid in a common trench, with 18 in. axial spacing, and with the necessary pilot cables accommodated in the same trench. Protection is by means of reinforced concrete covers. Along the road to the new power station, however, where the route becomes common with that of several 33 kV feeders, the 110 kV feeders have been laid well apart to ensure that each will carry the full specified loading of 75 MVA.

Overall diameter of the cable used is about 4⅛ in. and its weight is about 70 lb/yd. The maximum length per drum was 320 yd, and the gross weight of the drums worked out at between 12 and 13 tons. No difficulty, however, was found in pulling sections of this length over rollers in the normal way of cable laying. During all stages and especially as the last turn of cable was taken from the drum, particular care was exercised to ensure positive oil pressure within the cable.

Joints and Terminations

On one of the feeders there are 21 normal joints, compared with 20 on the other. The principal interior details of these joints are shown in one of the illustrations. They are contained in tinned copper shells, the sections of which are plumbed together with the cable ends plumbed on to the cable sheath. The completed joints are protected by reinforced concrete boxes filled with bitumen compound. At each end, the feeders are terminated by 0·3 sq in., single-core, paper-insulated, lead-screened, oil-filled cables jointed to the 3-core cable in trifurcating joints of similar construction to the 3-core joints, except that at one end provision is made for plumbing the sheaths of the single-core cables in separate glands. The oil ducts in the single-core cables are formed by the internally fluted lead sheath.

The other ends of the single-core cables are connected into sealing ends. At the power station, these are of the plug-in type and are connected into the 75 MVA transformers. At Donegall substation the tails terminate in outdoor type sealing ends mounted on the switchgear gantry.

Oil is fed into the cables at each end and at an intermediate point at the highest datum level along the route—a point which conveniently occurs about midway. A group of pre-pressured tanks is connected to the trifurcating joints at Power Station West, and a similar group of tanks is used at Donegall substation. The intermediate feed is provided by normal pressure tanks housed above ground at the Fleetwood Street substation. Oil pressure failure alarms are provided.

Consulting engineers are Merz and McLellan, and acknowledgment is made to Mr R. P. Watson, City Electrical Engineer and manager.

Above, workmen are laying the cable in the approach road to Power Station West; whilst below the jointers are finishing off the lead wire stress relief cores in a joint on the 110 kV cable

PROGRESS IN MINES RESEARCH

Electrical Work at Safety in Mines Research Establishment

FLAMEPROOF enclosures for electrical apparatus again receive attention in the 32nd Annual Report on Safety in Mines Research, published last week, which covers work during 1953. In this period 128 new applications were handled, and ten enclosures were failed. Particular mention is made of one motor in which the bearing housing was too weak to withstand the thrust exerted by the explosion on the end face of the rotor. The explosion did not propagate into the end of the motor enclosure remote from the point of ignition and the rotor, which was 18 in. in diameter, was moved axially by the force of the explosion.

Two motors failed during tests with external mixtures. One was a slip-ring motor in which the hollow shaft carried the leads from the rotor, in one flameproof compartment, to the sliprings which were in a separate flameproof enclosure. The shaft was inadequately sealed so that there was an opening through which flame was transmitted from one compartment to the other, an unacceptable feature with this form of structure. When the plastic compound originally used was replaced by a hard-setting bituminous compound all was satisfactory. The other motor that failed was a core-cooled motor which when dismantled after test was found to have a loose stator core, which resulted in a faulty joint between the core stampings and the compression ring.

Experimental tests outside certification procedure were made on a representative motor enclosure fitted with labyrinth-type shaft glands, and on a moisture-draining device for a range of electric motors, but no details of the results are given in the report. Outside the usual run of mining equipment is a detector for indicating the presence of "Freon," the refrigerent, which was approved.

Renewed attention was given during the year to the phenomenon of pressure-piling. When a gas mixture is ignited in one of two interconnected compartments abnormally high and rapidly rising pressures are sometimes developed in the compartment remote from that in which explosion is initiated, the pressure in the ignition compartment remaining low. "Pressure piling" is the term used to describe this type of explosion in the second compartment. When flame enters the second compartment from the interconnecting duct it is a pre-compressed mixture which is ignited, not one at atmospheric pressure. This effect of compartmenting is important in the design of f.l.p. electrical equipment, notably electric motors of the core-cooled type.

New work has been made possible by the development of a piezo-electric manometer, and this is being used in research on large core-cooled motors. One of the factors found to control the degree of pressure piling is the ratio of the volumes of the two compartments. The higher the ignition chamber volume/remote chamber volume ratio, the greater the pressure piling.

Sparks and Safety

Amongst the work carried out during the year was an experimental study of the relation between circuit parameters and the energy liberated in the spark produced when the circuit is broken. To check the results, the work was extended to include oscillographic studies of actual circuits. To study associated ignition processes, optical systems to examine a spark and the temperature wave which is propagated in its vicinity are being investigated. Direct photomicrographs of the spark can be obtained without much difficulty, and attempts were in progress at the Safety in Mines Research Establishment to examine short-period temperature changes in the surrounding gas.

A study has also been made of the relation between igniting current and circuit voltage in circuits of low inductance, a point of importance in connection with intrinsic safety. When the voltage is low and the current necessary for ignition correspondingly high, the ignition is found to be very dependent on the form of the electrodes and the type of break used. It has not been found possible to obtain ignition from sparks produced by short-circuiting the cable of a 4-volt cap lamp when the normal fuse is included in the circuit, even though high transient currents are produced before the fuse ruptures.

Ferromagnetic materials are used in the components of many practical circuits, and the minimum ignition current for single coils fitted with cores has been determined. Attention has also been given to the effect of a shorted turn in increasing the safety of the circuit, and the effect of the form and position of the turn are being examined.

Electrostatic Charges

Generation of electrostatic charges is a source of sparking which has to be watched. An example of the generation of charges of high voltage is given by a compressed air stemmer. However, these were only obtained under dry experimental conditions, and they are considered improbable in practice. Another example of electrostatic sparking occurred during trials at the manufacturers' works of a new belt conveyor. When the belt-fastener, of the wire-claw type, passed over a rubber-covered troughed guide roller, an electric spark jumped across the gap, some $\frac{1}{4}$ in. wide, between the fastener and the steel core of one of the rubber-sheathed drums of the roller. The belt was rubber covered, and a charge was gradually built up on the surface until it discharged in a single spark to the nearest earthed point. Sparks of the intensity witnessed would have ignited gas, but tests showed that they would not start smouldering of accumulations of fine coal dust such as might be present near conveyor structures.

The accumulation of static electricity on insulated surfaces is usually considered to depend largely on favourable atmospheric conditions of low humidity. This makes particularly puzzling an instance of static discharge from the belt of an underground conveyor where the relative humidity was over 30%. This is being investigated.

Mobile vacuum cleaning is another topic discussed in this valuable and interesting report. Its object is to remove coal dust at points where it is dropped in fairly large quantities from coal in transport. Care has had to be taken to avoid hazards arising from the formation of an inflammable atmosphere in one or more of the collecting chambers while the machine is idle. Some coals, when broken, give off a large amount of firedamp. The provision of vents on the container which open automatically when the machine is stopped provides the answer.

Precision Testing of Watthour Meters

Photo-cell technique leads to saving in time

A RAPID method for precision testing of alternating-current watthour meters has recently been developed by T. L. Zapf and A. W. Spinks of the U.S. National Bureau of Standards. This method reduces to a minimum the use of an electrodynamic wattmeter and the laborious process of holding the a.c. power constant while the meter registration is accumulating. In place of the regular use of the electrodynamic wattmeter for all tests, measurements may now be made by a comparison process that employs a group of carefully selected a.c. watthour meters, one of which has been adapted for use as a "standard watthour meter" while the others serve as comparison standards. Specifically the rate comparisons are performed by comparing the number of revolutions of the disc of the watthour meter under test with that of the standard meter. The standard meter must, of course, initially have had its rate accurately determined by the older wattmeter method.

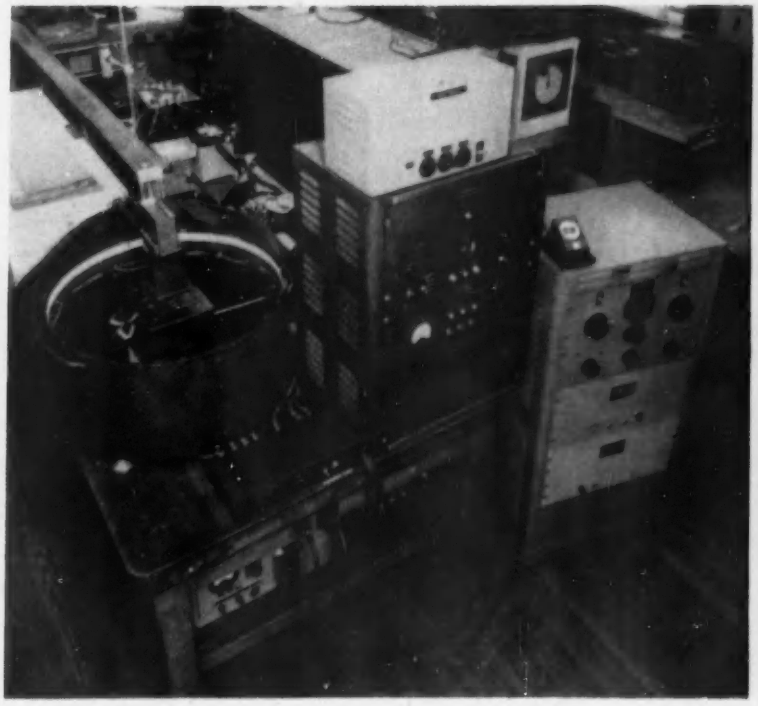
The U.S. Bureau of Standards' test consists of determining values for percentage registration of the meter at various combinations of current, voltage, and power factor. In high-precision tests this has, in the past, ordinarily been done by observing the number of disc revolutions occurring in a fixed time interval during which the power has been held constant. The power is indicated by the deflection of an electrodynamic wattmeter previously calibrated from direct current. This fundamental procedure is capable of high accuracy but is necessarily tedious and difficult.

The meter selected as a standard is a modified portable commercial watthour meter (rotating standard). This unit is provided with a shaft extension, its register removed and is mounted in a temperature-controlled box. A light-beam pointer is provided by mounting a mirror inclined at 45 degrees on the upper end of the shaft. A beam of light, incident vertically on the mirror, is deflected horizontally to an encircling scale provided with a phosphorescent band. A phototube is placed behind a vertical slit in the phosphorescent band so that the light beam strikes the phototube once each revolution. The amplified pulse from the phototube energises an electromagnetically-operated mechanical counter for counting the number of complete revolutions of the disc of the standard watthour meter during a run.

A mercury-vapour lamp placed above a small circular aperture serves as the light-pointer source, and lens focuses the image of the aperture on the phosphorescent band. Any current pulse through the lamp will cause momentary intensification of the light which results in a luminous spot being left on the phosphorescent band. This spot will persist for several seconds, long enough for an operator to note its position on the engraved plastic scale.

Method of Operation

In one method of operation, the duration of a test run is determined by a photoelectrically-operated controller that counts a preset number of complete disc revolutions of the watthour meter under test. This method can only be employed if the meter under test is of a type readily adapted to photoelectric pick-off. Precisely at the beginning and end of each run the amplified output from the phototube associated with the watthour meter under test triggers an electronic circuit that pulses the mercury-vapour lamp and produces a persistent spot of light on the phosphorescent band. The positions of these two spots—one at the beginning and one at the end of the run—can be read to the nearest thousandth of a revolution on the adjacent scale. Any fractional part of a revolution of the standard watthour meter can be computed from these two readings. Thus, the number of revolutions of the disc of the standard equals the reading of the mechanical counter plus the scale reading at the end of the run, minus the scale reading at the beginning of the run. The use of a light beam pointer of this type completely eliminates the friction associated with mechanical registers. An outstanding feature of the apparatus, when used in this manner, is that the circuit for the starting and stopping of



A general picture of the equipment used at the U.S. Bureau of Standards. The standard meter is inside the circular enclosure on the left with the mercury-vapour lamp in the central housing

the test run does not depend upon the opening or closing of relay contacts; hence, the run is completely free of relay errors.

In another method of operation, the photoelectrically-operated controller may be triggered by the phototube associated with the standard watthour meter, in which case the run consists of a predetermined number of complete revolutions of the standard. The potential circuit of the watthour meter under test is closed at the beginning of the run and opened at the end of the run by relays operated by the controller. When this method is used, the duration of the run is made sufficiently long to render negligible any start-stop errors in the watthour meter under test. The relays which close and open the potential circuit are carefully adjusted to eliminate errors due to unequal lag times in their operation.

In addition to the standard watthour meter, three comparison watthour meters are kept in a temperature-controlled cabinet and used to check the reference standard as often as desired. These meters, too, have been chosen for their good stability and have their registers removed to reduce friction. A check of this sort can be made in a few minutes.

The standardisation of watthour meters by this method eliminates the necessity of measuring power accurately and holding power constant for an accurately measured time interval, because in the rate-comparison method moderate fluctuations in power affect both the watthour meter under test and the standard in the same way. Precise results are assured by calibrating and operating all meters at rated load, by reducing friction in the standard meter through removal of their gear trains, by maintaining all standards at a constant temperature, and by energising the standard watthour meter continuously during test, thereby eliminating starting and stopping errors in this meter.

B.E.A. Plant Installed in 1954

THE year just ended saw an increase of 1,431 MW in the B.E.A.'s installed generating capacity, the rise being 18 MW higher than that experienced in 1953. Apart from from steam-driven plant, which amounted to 1,405 MW distributed among 29 turbo-alternators, there was an additional 25·78 MW of diesel driven generators. Exactly the same number of steam stations as the previous year, 34 in all, were affected by the commissioning, which, apart from sets, included 50 boilers, aggregating an evaporative capacity of 16,220 klb/hr.

Turning to diesel plant, 9 stations were involved, including a new station; Ashford B (S.E.) where two, 2 MW Mirrlees, Bickerton and Day sets were installed. Other stations are: Alderley Edge (N.W., M. and N., Wales) one 2 MW set; Barugh (Y) two 2 MW sets; and Buxton (N.W., M. and N. Wales) two 2 MW sets, all these being Mirrlees machines; Blackpool (N.W., M. and N. Wales) five 1·28 MW, Harland and Wolff; Clacton (E.) one 0·95 MW, and Southend (E.) one 0·95 MW, both English Electric; Haverfordwest (S. Wales) two 1·22 MW, Crossley and Newbury (S.) one 1·04 MW, Ruston.

The rate of commissioning in 1954 was again adversely affected during early construction stages by shortages of steel, now, happily, largely overcome so that 1955, should see an even greater increase. Despite last year's steel position the total of new plant falls only a little short of the level of commissioning of 1,450 MW sanctioned by the Government for 1954.

Plant Commissioned in B.E.A. Power Stations during 1954

Station	Division	Turbo-Alternators			Boilers			Main H.P. Pipework Maker
		No.	Rating MW	Maker	No.	Rating klb/hr	Maker	
Acton Lane 'B'*	London	1	30	R., W.	2	240	Mitchell	Aiton
Barking 'C'	London	1	75	B.T.H.	2	405	Babcock & Wilcox	Aiton
Battersea 'B'	London	—	—	—	1	425	Babcock & Wilcox	Aiton
Blackburn	N.W., M, N. Wales	1	40	E.E.	2	150	Simon-Carves	Babcock & Wilcox
Bold 'A'	N.W., M, N. Wales	1	30	M.V.	1	300	Yarrow	Aiton
Braehead	S.W. Scotland	—	—	—	1	300	Babcock & Wilcox	Babcock & Wilcox
Brighton 'B'	S.E.	—	—	—	1	320	Babcock & Wilcox	C. A. Parsons
Brunswick Wharf	London	1	52·5	M.V.	4	320	Clarke, Chapman	C. A. Parsons
Carmarthen Bay	S. Wales	1	60	M.V.	2	240	Babcock & Wilcox	Stewart & Lloyds
Carrington	N.W., M, N. Wales	1	60	M.V.	1	360	Babcock & Wilcox	Stewart & Lloyds
Chadderton	N.W., M, N. Wales	1	60	M.V.	3	360	Simon-Carves	Stewart & Lloyds
Cliff Quay	Eastern	—	—	—	1	365	Babcock & Wilcox	Aiton
Connahs Quay	N.W., M, N. Wales	1	30	Parsons	1	300	International Combustion	J. Thompson
Deptford East	London	1	52·5	M.V.	1	250	Foster Wheeler	J. Thompson
Doncaster	Yorks	1	30	G.E.C.	1	180	Mitchell	Aiton
Drakelow 'A'*	E. Midlands/Midlands	1	60	E.E.	1	515	International Combustion	Aiton
East Yelland	S. Western	1	30	Parsons	2	180	J. Thompson	C. A. Parsons
Hackney 'B'*	London	1	30	Parsons	1	300	Simon-Carves	C. A. Parsons
Huddersfield	Yorks	—	—	—	1	180	Bennis	C. A. Parsons
Ince*	N.W., M, N. Wales	1	60	G.E.C.	1	550	International Combustion	Babcock & Wilcox
Keadby	Yorks	2	60	Parsons	2	550	Stirling	C. A. Parsons
Littlebrook 'C'	S. Eastern	—	—	—	1	360	International Combustion	C. A. Parsons
Nechells 'B'	Midlands	—	—	—	2	230	International Combustion	Stewart & Lloyds
Portobello	S.E. Scotland	1	60	R., W.	1	540	International Combustion	Aiton
Roosecote	N.W., M, N. Wales	2	30	M.V.	2	300	Yarrow	Aiton
Skelton Grange 'A'	Yorks	2	60	Parsons	1	550	International Combustion	Aiton
Southport	N.W., M, N. Wales	—	—	—	1	85	Yarrow	Stewart & Lloyds
Staythorpe 'A'	E. Midlands	—	—	—	1	240	Babcock & Wilcox	Babcock & Wilcox
Stourport 'B'	Midlands	1	60	E.E.	1	515	International Combustion	Aiton
Stella South*	N. Eastern	1	60	Parsons	1	550	Clarke, Chapman	C. A. Parsons
Thornhill	Yorks	1	45	E.E.	1	200	Mitchell	Stewart & Lloyds
Uskmouth 'A'	S. Wales	2	60	G.E.C.	5	360	Babcock & Wilcox	Aiton
Wallasey	N.W., M, N. Wales	—	—	—	1	85	Yarrow	Stewart & Lloyds
Walsall	Midlands	2	30	B.T.H.	—	—	—	Aiton

*New station during 1954.

around the trade

by Peregrin

THE beginning of a New Year is as good a time as any to have a grouse, and I found a retailer friend thus occupied on New Year's Day. He was surrounded by trade lists and catalogues, and grumbling about all of them. This surprised me, for I thought last year was notable for the excellent catalogues produced by the manufacturers, many of which were superior to pre-war standard. My friend agreed on this, but asked plaintively why every manufacturer had to choose a distinctive size, style, colour and lay-out, thus making a search through several lists a feat requiring considerable intelligence—and time.

There is a lot in this complaint. The various sizes alone make the office shelves look untidy, and are an obstacle to any kind of filing system, but the trouble only begins there. Almost every list has its own system of description and pricing, and it is irritating to have to unravel the secrets of each one in turn. Some show the price and purchase tax against each item. Others give a numbered price list at the end of the book, but not all at the same end. Some lists leave the reader to work out the purchase tax for each item, if he does not forget. Again, some lists show dimensions, colours and "extras," against the illustrations of the items, while others prefer a code system which requires a good deal of cross reference, and close study of complicated tables after obeying the instruction "Turn to Page—."

One excellent catalogue presents the illustration, the retail price, the wholesale price in code, the tax if any, the dimensions and other details, all on the same page, but of course it becomes useless overnight by a change in price or tax.

A very prominent manufacturer, not unknown in Kingsway, has done a good deal towards solving this problem, by issuing standard catalogues and loose-leaf supplements. The books are of sensible size, easy to handle, and can easily be kept bang up-to-date, come increase or reduction, if the owner takes the trouble to remove the obsolete sheets and replace them, with the new ones, which are sent regularly and unasked for.

My dealer friend had one final moan. Even the titles on the back edges of the catalogues are not all the same way round, and he gets "Wimbledon Centre Court" neck in trying to read the names, if he has not managed to memorise them. That affliction is not a monopoly of electrical catalogues, as every book-lover knows.

The Biter Bit

At a recent E.C.A. branch dinner I attended, the toast of "Our Guests" was responded to by a well-known local architect. The Branch Chairman, in proposing the toast, had revealed that the architect was building a house for himself and commented playfully on the immense possibilities of such a situation. The architect confessed his guilty secret, but protested that it was no joking matter, for he had discovered that while it was the easiest thing in the world to plan the requirements of another man, when it came to apply his knowledge and experience to a place for himself he hardly knew where to begin.

I sympathise with the speaker, for I am now engaged in a similar enterprise and I am also oppressed by the same doubts. I always thought I knew exactly what I should install when I built myself a house. I imagined the perfect installation, with the last word in lighting, ample outlets, efficient heating, an electrical dream of a kitchen, and all that. Yet, though I am accustomed to devising elaborate, and doubtless adequate, specifications for other people's houses, I can make no headway with one for myself. With the plasterers almost straining at the leash, I cannot yet decide where to place the cooker, what kind of electric heating to adopt, whether to bother with sunk switches after all, and so on. So I am afraid that an electrical visitor, a year or so after we have moved in, will easily spot the inevitable flex extension trailing round a door, and an added point in clipped t.r.s. trying to look unobtrusive, —the usual signs of bad planning, or shall we say wifely afterthoughts.

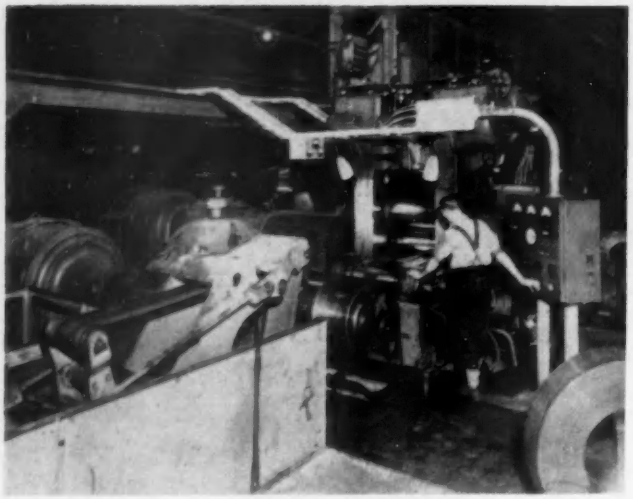
But I shall not make the mistake of being niggardly with socket-outlets. At the moment there is a welcome revival, in more than one quarter, of the demand for more socket-outlets, and it is all to the good. That old anachronism, "one light one plug per room" dies hard, but electrical contractors can do a lot towards killing it. It is strange how some contractors, who make little apparent effort to encourage a customer to install plenty of outlets in his original installation, do not seem to mind selling him plugs and cable afterwards, so that he can make good the shortage himself. Numerous socket-outlets are good business for the wholesaler, the contractor and the appliance retailer, and the customer never begrudges them, for he will still find that he has not enough.

Purchase Tax Again

Purchase tax becomes topical about this time of year, but now we only speculate about a possible reduction and if so how much. Not so long ago the public were urged to hurry up and buy before the Budget, in case the tax went up. No one dreamed of it going down. Now there is a tendency to buy as little as possible after Christmas in case the tax goes down in April. It is a curious state of affairs. Many retailers, with the understandable awareness of paid tax that cannot be recovered, much prefer the relief of an announcement now that there will be no reduction, to the suspense of waiting for the Budget and a possible surprise reduction. Others take the view that purchase tax reduction is inevitable, indeed desirable, so lets get it over as soon as possible, and, after all, an announcement now that there will be a reduction in April, would be a worse calamity than no announcement at all, for in that case people might stop buying altogether. However unfair one may regard the retailer's position with regard to tax, and unfair it certainly is, a tax reduction always gives a fillip to trade, so the dealer should soon make up for his loss on tax-paid stock.

Electrical Drive for a Temper Mill

CONTROL EXCITER SCHEME FOR MAINTAINING STRIP TENSION



PARTICULARLY difficult electrical problems are involved in the design of drives for temper mills. In this form of mill the steel strip is subjected to a combination of tension and pressure in passing through the rolls, and it is vital, to secure uniformity of the product, that the tension should remain constant throughout the process, and also during the periods of acceleration and deceleration. As the strip is unwound from an entry reel and fed on to a take-off reel it is, in addition, essential to control these reels so that the changing diameter of the work does not affect the tension.

An interesting example of drive technique is that adopted by the General Electric Co at the Courtybella Works of the Whitehead Iron and Steel Co., Newport, where a new 21 in. single stand 4-high temper mill has recently been commissioned. The mill itself was made by the Davy and United Engineering Co.

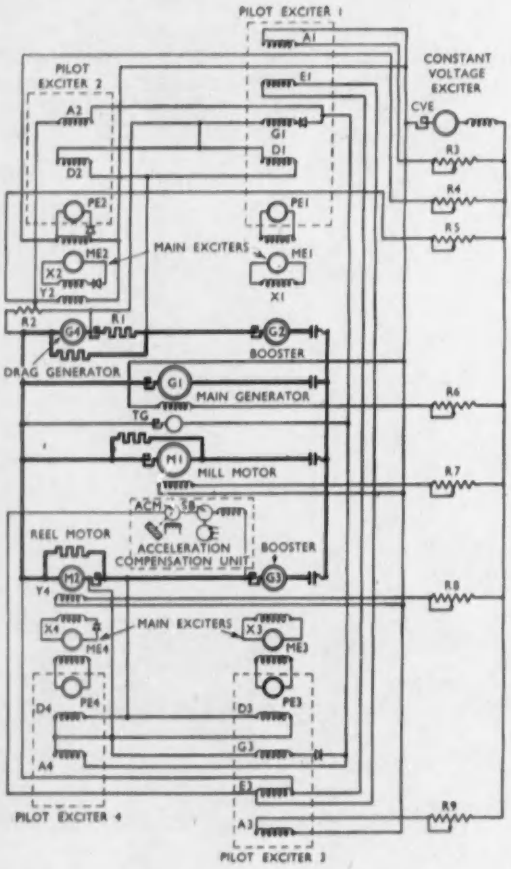
Mill Motors

The main mill motor is a d.c. machine rated at 0/200/200 h.p., 0/250 V, 0/300/750 r.p.m., and two further machines govern the tension, one, a drag generator, rated at 50 kW 0/350/350 V 0/300/950 r.p.m., coupled to the entry reel and the other a 0/150/150 h.p., 0/350/350 V, 0/350/750 r.p.m. motor connected to the coiler. This latter machine is equipped with an electro-magnetic brake.

The d.c. supply for the mill drives is obtained from a motor generator set consisting of a 435 h.p. 6 kV slipring induction motor driving a d.c. generator with an output of 0/300 kW at 0/250 V. For control purposes, however, three smaller motor generator sets are provided, one consisting of a 70 h.p. squirrel cage motor driving a 37 kW delivery reel booster, a 20 kW entry reel booster and a 9·5 kW constant voltage exciter, and the other two sets are groups of four control exciters driven at 2,900 r.p.m. by 6 h.p. motors.

The Control Scheme

The basis of the scheme is founded on the control exciters, each of which is fundamentally a d.c. machine with conventional armature and brush gear, but with a completely laminated magnetic circuit and with a number of separate field windings. It will be seen from the schematic diagram that the drag generator (G4) and reel motor (M2) and their respective boosters (G2) and (G3) are each excited by means of two control exciters connected in cascade. Power supply for the main mill motor (M1) and for (G4) and (M2) is obtained from the main generator of the m.-g. set. The various control sequences are thus initiated by adjustment of the voltages applied to the



Top: Delivery side of the temper mill showing main control cabinet and the 150 h.p. coiler motor

Left: Schematic diagram of control system

field windings of the motors, generator and exciters, the primary source of these voltages being the constant voltage exciter CVE. Acceleration of the main mill motor is achieved first by increasing the field and consequently the output voltage of (G1), and then by weakening the field of the mill motor (M1). The reverse is carried out when decelerating.

To keep the tension in the strip constant at any constant speed of the main motor, it is necessary to keep the outputs of both (M2) and (G4) constant. Thus the current flowing in each armature and the voltage must be kept constant. Further, when acceleration or deceleration takes place, the voltage generated in each armature must vary in direct proportion to the strip speed. Control exciters (PE2) and (ME2) thus operate to keep the voltage generated in the armature of (G4) constant—while the strip speed is constant—irrespective of the speed of entry reel, and control exciters (PE4) and (ME4) perform the same function for (M2). The current through each of the armatures is kept constant by the exciters (PE1), (ME1), which control the field of booster (G2) for (G4), and by (PE3), (ME3), via G3 for M2.

Auxiliary motor generator sets and control exciters

Delivery End Control

It is obvious that some reference must be provided to the pilot exciters, and in the case of the delivery end control, this is obtained from the constant voltage busbars through the delivery reel tension setter (R9). The current through this resistance energises reference winding (A3) on pilot exciter (PE3), and builds up the excitation and output of booster (G3) until the winding (A3) is almost balanced by winding (D3). This second winding is energised from the compoles of motor (M2) and thus produces an effect proportional to the motor current. Thus the current—and the strip tension—is controlled by the strength of field (A3).

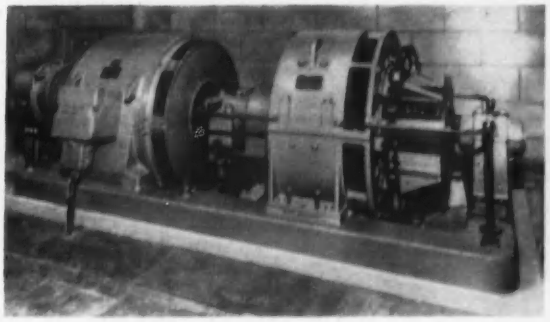
Now the speed of the reel motor (M2) is dictated by the strip speed, and by the diameter of the coil on the reel, and to maintain the e.m.f. of the reel motor constant, the motor field must be progressively strengthened by the associated control exciter set (PE4-ME4).

This is accomplished by using two field windings (Y4) and (X4) on the reel motor. (Y4) is sufficient to provide correct generated voltage in the armature with the motor running at maximum (empty reel) speed, while (X4) assists (Y4) to keep the voltage constant as the reel motor slows up under filling conditions.

The field winding (X4) is controlled by the exciters (ME4) and (PE4) and the winding (A4) of (PE4) is energised by the difference of two e.m.f's, one supplied by a tacho-generator (T.G.) driven by the mill motor and proportional to the strip speed, and the other generated in the reel motor armature. Thus if the reel motor e.m.f. tends to be less than that of the tacho-generator—as when the motor slows down under coil build-up, the resultant voltage across (A4) increases and the exciters strengthen the field winding (X4) of the reel motor and restore its e.m.f. to the correct value to oppose the e.m.f. of the tacho-generator. The field winding (D4) on exciter (PE4) is energised from the compole winding of the reel motor and compensates for the armature resistance drop in the reel motor.

Change of Speed

During acceleration, the reel motor requires increased current to provide the accelerating torque, and similarly during deceleration the stored energy of reel and motor must be given up. It is thus necessary to provide excitation which increases the tension reference field (A3) during acceleration and decreases it during deceleration. To accomplish this, the winding (E3) is connected in series with an acceleration compensating motor (ACM) and a small series booster across the armature and compoles of the delivery reel motor. Under steady conditions, the acceleration compensating motor produces a back e.m.f. to balance the voltage across the reel motor (M2), and takes only a small current to supply its rotational losses. This motor is however coupled to a flywheel and although the acceleration is the same as that of the reel motor—as they both are affected by the rate of change of voltage across the reel motor armature, the current taken by the (ACM) is proportional to the inertia of the flywheel, and thus to the acceleration of the reel motor armature. This current is used to energise winding (E3) to assist (A3) and thus automatically increases the current setting by the amount required to accelerate the reel motor armature. Under deceleration the back e.m.f. of (ACM) exceeds the voltage of (M2), and the current through (ACM) is reduced and eventually reverses causing the flywheel to drive the motor as a generator. Winding (E3) then acts in the reverse sense to oppose winding (A3) thus reducing the current setting by the amount required to decelerate the reel motor armature. Series booster (SB) compensates for the IR drop in the circuit and ensures that the back e.m.f. of (ACM) accurately reflects the voltage generated by the reel motor (M2) at all times. The current in (ACM) and hence in field coil (E3) thus reflects the rate of change of speed of (M2) and provides accurate compensation under changing speed conditions.



435 h.p. motor generator set for main drive

Additional precautions are taken to prevent running away of motors in the event of strip breakage and a stalled tension switch is provided to enable a pre-selected value of tension to be maintained in the strip when the mill is at a standstill.

Entry Tension

At the entry end a similar system as that described for the delivery end is used, both the current developed by the drag generator (G4) and its generated voltage being controlled. However, whereas on the delivery side the field winding of (ME4) is fed direct from the armature of (PE4) on the entry side the field of (G4) is fed from the constant voltage exciter via (R4). As the coil diminishes in diameter for a given strip speed, the speed—and consequently the e.m.f. of (G4) tends to increase above that supplied by the tacho-generator (TG). This voltage difference is again used to provide via the control exciters a correcting function. In addition correcting functions for acceleration and deceleration are provided in a similar manner as already described for the delivery end, but in, of course, opposite sense.

Acknowledgment is due to the Whithead Iron and Steel Co., Ltd., for the photographs and information given above.

HYDRAULIC CONTROL FOR ARC FURNACES

MODERN arc furnace design for steel melting is well exemplified in a recent installation supplied to the Clyde Alloy Steel Co., Ltd. The furnace was installed by G.W.B. Furnaces Ltd., of Dudley, and is to the designs of the Italian firm, L. Tagliaferri, of Milan. The method of electrode regulation based on Ing. L. Tagliaferri's work is hydraulic in operation and while argument still exists as to the relative merits of hydraulic as against electro-mechanical devices for electrode regulation, the high speeds and rapid acceleration obtained with the hydraulic system have been largely responsible for the high efficiency obtained with this particular furnace.

Method of Operation

The electrodes are attached to pistons, the movements of which are caused by water under pressure, the flow being governed by a valve which is operated by oil pressure on one side and an opposing spring on the other. Variations in the electrode current (caused by the state of the charge, and the process of melting) are reflected in a movable magnetic core attached by a rod to a piston controlling the flow. It is evident in such a system inertia is reduced to very small proportions.

Furnace charging is considerably facilitated by the provision of a lift and swing-aside roof. This method speeds up loading which is carried out by means of a drop-bottom steel charge basket.

The average melting time required per charge, which consists of mild steel scrap and turnings, has been found to be 2·16 hours with a 3-ton charge although it is of interest to learn that in spite of this weight being the maximum nominal capacity, charges of 4·25 tons have been used. As would be expected with the type of charge the refractory lining is of the Basic type.

The furnace is rated at 2 MVA and is fed from a 6·6 kV supply through a transformer of suitable capacity; the electricity consumed per ton of metal melted is 650 kWh.

Three ton arc furnace with hydraulic control of electrode

Graphite electrodes are employed, these being 8 in. in diameter while a low consumption of 10 lb of electrode per ton of metal produced is achieved.

The hydraulic electrode control is part of a common system providing motive power for tilting the furnace body, lifting and swinging aside the roof and raising the door. A pair of electric pumps are fitted (one spare to ensure continuous operation) in the sump supplying water to the accumulator tank to which is also connected a compressed air bottle. The primary function of the compressed air feed is to damp the pressure oscillations which may occur during operation and to permit lifting the electrodes in the event of failure in the electric supply to the feed pumps. An interesting feature in regard to case of working is the method of holding the electrodes in position, which is effected by spring-loaded clamps; unclamping is easily accomplished by means of an off-take from the hydraulic pressure system thus reducing to a minimum unpleasant maintenance work on top of the hot furnace lid.

NEW YEAR HONOURS

MANY AWARDS IN THE ELECTRICAL INDUSTRY

ONCE again the valuable services of many well-known figures in the Electrical Industry are recognised in awards in the New Year's Honours List announced last Saturday. Firstly there are two new barons—**Professor E. D. Adrian,** O.M., president of the Royal Society and of the British Association, and **Sir Arnold Babb Gridley,** K.B.E., M.I.E.E., M.P., chairman and joint managing director of Mawdsleys Ltd., chairman of Southern Areas Electric Corporation Ltd., and a director of a number of other electrical concerns, who has been Member of Parliament for Stockport since 1935. Sir Arnold has been actively associated with the Electrical Industry for over fifty years. **Sir John Maud,** K.C.B., C.B.E., permanent secretary, Ministry of Fuel and Power, gets the G.C.B.

Among those who receive a Knighthood are **Dr Ivor R. Cox,** D.S.O., HON. D.SC., M.I.MECH.E., A.M.INST.C.E., who last Oct. was appointed group managing director of the Associated Electrical Industries' Overseas Group (the award is for his services as managing director of Metropolitan-Vickers Electrical Co., Ltd.); **Mr P. E. Millbourn,** C.M.G., who, apart from being honorary adviser on shipping in port to the Minister of Transport and Civil Aviation, is chairman of Thermega Ltd., and of other concerns; **Colonel G. A. Wade,** M.C., J.P., who is chairman and joint managing director of George Wade and Son, the porcelain firm; and **Mr Gordon Russell,** director of the Council of Industrial Design.

C.B.E.

Recipients of the C.B.E. include **Mr C. T. Melling,** M.SC.TECH., M.I.E.E., M.I.MECH.E., M.INST.F., F.I.I.A., chairman of the Eastern Electricity Board, who has also held many other important offices, including chairmanship of the Council of E.D.A. (Prior to nationalisation of the industry, Mr Melling was borough electrical engineer at Luton for three years); **Mr V. A. Patterson,** J.P., deputy chairman and managing director of J. and E. Hall, Ltd.; **Professor C. H. Smith,** M.SC., M.I.E.E., Professor of Instrument Technology at the Royal Military College of Science; and **Mr Alfred Watson,** B.SC., M.I.E.E., M.I.MECH.E., chief mechanical and electrical engineer, Air Ministry.

O.B.E.

Among those who are awarded the O.B.E. are **Mr Robert Connor,** director and general manager of Measurement Ltd.; **Mr H. Duckworth,** M.I.E.E., superintending electrical engineer, Admiralty Engineering Laboratory, at West Drayton; **Mr H. R. Lindars,** managing director of Dunford and Elliott (Sheffield) Ltd. (the award is for his services in connection with fuel efficiency—he has made valuable contributions to the problems in automatic combustion control for boilers and furnaces); **Mr Peter Philip,** M.I.E.E., M.I.MECH.E., M.INST.F., manager of the Dundee area of the North of Scotland Hydro-Electric Board, who has been associated with the Dundee undertaking since 1908 (he was city electrical engineer there from 1941 to 1948); **Mr V. W. M. Roberts,** B.SC., A.M.I.E.E., manager of the Electronics Department of the British Thomson-Houston Co., Ltd., and a director of Multi-Broadcast (Engineering) Ltd.; **Mr G. A. Vowles,** M.I.E.E., M.I.MECH.E., who has been controller of the Yorkshire Division of the B.E.A. since 1948, and was earlier, chief engineer and transport manager of the Ipswich Corporation Electricity and Transport Department for over 8 years; and **Mr F. A. Gould,** lately senior principal scientific officer of the N.P.L.

M.B.E.

The lengthy list of recipients of the M.B.E. includes the names of **Mr G. Anderson,** manager of the Welding and Fabrication Department of Bruce Peebles and Co., Ltd.; **Mr F. H. Crocombe,** M.M., district engineer, Minehead District of the South Western Electricity Board, who has been associated with the Minehead electricity undertaking since 1912; **Mr D. Dunsmore,** superintendent with the Brush Electrical Engineering Co., at Loughborough; **Mr D. Fairweather,** chief of crystal production, Marconi's Wireless Telegraph Co., Ltd.; **Mr W. Fielding,** senior telecommunications superintendent, North Eastern Region, G.P.O.; **Mr W. Geary,** assistant superintendent, Metropolitan-Vickers Electrical Co., Ltd.; **Mr A. E. Hill,** manager of the Chesterfield Glass Works of the British Thomson-Houston Co., Ltd.; **Mr C. C. Knowles,** works manager at Birmingham to William McGeoch and Co., Ltd.; **Mr C. J. Lever,** works manager at West Hartlepool and Spennymoor for Siemens Brothers and Co., Ltd.; **Mr W. R. Peatling,** apprentice supervisor, Telegraph Construction and Maintenance Co., Ltd.; **Mr W. S. Read,** manager of the Fraser and Chalmers Engineering Works, Erith; **Mr J. J. Sarche,** chief inspector, Ultra Electric Ltd.; **Mr H. E. Wasser,** A.M.I.E.E., chief testing engineer, Midlands Division of the B.E.A.; and **Mr A. E. Smith,** senior executive officer, Ministry of Fuel.

B.E.M.

Those awarded the British Empire Medal include **Mr W. W. Aked,** electrical fitter, J. Stone and Co. (Deptford), Ltd.; **Mr J. Anderson,** substation attendant, at Edinburgh, with the South East Scotland Electricity Board.; **Mr J. Beck,** leading turbine driver, at Kilmarnock power station, South West Scotland Division, B.E.A.; **Mr F. Collison,** chargehand jointer at Middlesbrough, North Eastern Electricity Board, **Mr G. H. England,** jointer at Weymouth, with the Southern Electricity Board; **Mr L. F. Hitchcock,** electrician at Tonbridge, South Eastern Division, B.E.A.; **Mr E. T. Hodgson,** jointer at Keswick, North Western Electricity Board; **Mr A. Nightingale,** turner with British Insulated Callender's Cables Ltd., at Prescot; **Mr W. M. Robinson,** senior foreman with R. B. Pullin and Co., Ltd., Teddington; **Mr G. Sparks,** chief electrical inspector, William McGeoch and Co., Ltd.; and **Mr F. C. Waller,** fitter (electrical) Enfield, Eastern Board.

OVERSEAS

Of the numerous overseas awards, we note that **Mr G. T. Chippindall,** C.B.E., director-general of the Australian Posts and Telegraphs receives a Knighthood; **Mr E. H. R. Green,** M.SC., M.I.E.E., chief engineer of the New Zealand Posts and Telegraphs gets the C.B.E., while the O.B.E. goes to **Mr J. J. Malone,** M.C., formerly chairman of the Overseas Telecommunications Commission and deputy director, Posts and Telegraphs, New South Wales, and **Mr T. H. Matthewman,** M.I.E.E., who is principal of the Engineering College at Dacca, Pakistan. The B.E.M. is awarded to **Manuel Rodriguez,** shift charge man at Gibraltar City Council's power station.

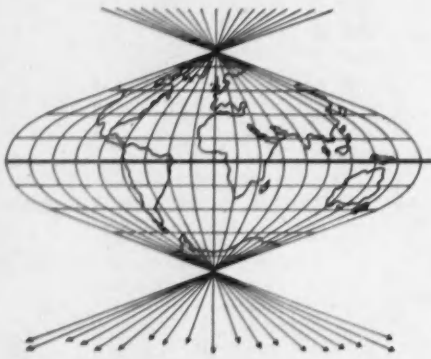
Sir Arnold Gridley (Baron)

Dr I. R. Cox (Kt)

Mr C. T. Melling (C.B.E.)

Mr G. A. Vowles (O.B.E.)

Mr V. W. M. Roberts (O.B.E.)



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

McArthur Falls in Operation

The first four 10,000 h.p. generating sets at the McArthur Falls plant of the Manitoba Hydro-Electric Board, were put into operation a few days ago—thus achieving the target date set out over two years ago by Mr D. M. Stephens, chairman of the Board. Four more similar sets are to be installed to bring the plant up to its full 80,000 h.p. capacity by next June. McArthur Falls is the sixth generating station to utilise the waters of the Winnipeg River, and, according to reports, it is likely to be the last one built along the river as there are no more suitable sites available. In bringing the plant to completion by the target date, construction workers carried on throughout two of the worst building seasons in the history of Manitoba and last summer fought the highest flood levels ever experienced on the Winnipeg River.

Switchgear for Canada

The British Thomson-Houston Co., Ltd., announce that an order has recently been received for six 230-kV, 7,500 MVA Type JW419 oil circuit-breakers for the British Columbia Electric Company's power transmission system.

Stopping "Bid Peddling"

In an effort to squash "bid peddling" the National Association of Master Plumbing and Heating Contractors of Canada has passed a resolution advising all members to refuse to submit tenders to general contractors. The Association wants the tenders to be made direct to the architect or owner, who would choose the lowest suitable offer. The Federal Public Works Department has also announced that henceforth general contractors will have to give names of subcontractors they will use on jobs when submitting their tenders. This action, according to our information, is the result of the cloak and dagger practice of "bid peddling," which has been prevalent in the industry in recent months. When a bid is "peddled," either a general contractor gets a subcontractor to undercut the lowest subtrade bid submitted to him or a subcontractor gets someone in a general contractor's office to reveal the amount of the lowest bid. The devious subcontractor then offers to undercut. The practice is a symptom of the increasingly competitive conditions in the industry. Mr C. W. Dent, president of the Toronto zone of the Electrical Association of Ontario, approves the action taken to combat the tendency. He has said that electrical contractors do not believe that their tenders get the secrecy from the general contractor that they would from the architect. The latter should receive trade bids, select the successful tenderer and then pass price and name to the general contractor as a nominated subcontractor, he suggested.

CARRIBEAN

Strike Trouble

Following a strike by the employees of the Port-of-Spain Corporation Electricity Board (which takes a bulk supply from the Trinidad and Tobago Electricity Commission for distribution within the city) there were fairly widespread interruptions of supply in the city, we hear. His Excellency the Governor, therefore, on the evening of 22 Dec. declared a state of emergency and made an order thereunder authorising the Trinidad and Tobago Electricity Commission to take over the powers in connection with the distribution of electricity previously exercised by the Port-of-Spain Corporation Electricity Board. The Commission succeeded in restoring all supplies shortly after midnight, and has since continued to operate the city's power system. How long the Commission is to do so is not yet known.

U.S.A.

Selling St. Lawrence Output

The New York State Power Authority has floated a $330 millions bond issue towards financing construction of the United States' side of the joint American-Canadian power project in the International Rapids section of the St Lawrence River. In announcing the issue, Mr Robert Moses, chairman of the Authority, indicated that he expected much of the U.S. share of the output of power project to remain in the developing northern part of the country. He revealed that a tentative agreement had been reached under which the Aluminium Co. of America would receive about one-third of all the energy generated on the U.S. side of the river during the early years of operation. Conferences were proceeding with all responsible interested agencies for the sale of the remaining power, he added. Plant construction was proceeding according to schedule, with the first delivery of power due in four years.

Foreign Contract

A contract for transformers for the Cheatham Lock and Dam, in Tennessee, has been placed by the U.S. Army Corps of Engineers with an Italian firm, Industrie Electtriche di Legnano. The contract, valued at $137,351, is for three 12,000 to 16,000 kVA 3-phase transformers. This is the first such award to a foreign firm since President Eisenhower slightly modified the Buy American Act restrictions against Government purchases from foreign concerns. It is understood that the Italian firm's tender price was 13½% under the lowest American bid of $156,028 by the Allis-Chalmers Manufacturing Co.

NORWAY

Underground Extension

Oslo's City Council recently agreed upon a plan to add three new lines to its underground railway system. There is at present only one line from the centre of the city to the northern outskirts. The proposed extension will serve the new suburbs to the south and south-east of the city. Work on the project is to begin immediately.

EUROPE

Order for Generating Plant

It is reported from Madrid that an order valued at nearly £2m., is to be placed with Metropolitan-Vickers Electrical Co., Ltd., for generating plant for five new steam power stations in Spain. We understand that the contract, which has been obtained in face of keen competition, only awaits the formal approval of the Spanish Minister of Commerce. The contract is for six hydrogen-cooled turbo-alternators, four of which will be of 30 MW rating, one of 15 MW and one of 7,500 kW. The four 30 MW sets are to be installed at sites along the southern coast of Spain—two will be in a power station at Cadiz, one at Almeria and the fourth at Malaga—while the 15 MW set is for Palma de Majorca and the 7,500

kW unit for Ceuta, Spanish Morocco, Spain, of course, has large scale hydro-electric schemes in operation and under construction, but mainly due to poor rainfall, greater recourse has had to be made to the thermal power stations, most of which have been overloaded at times in recent years.

U.N. Discussions

Provisional reports on eleven subjects ranging from the operation of wind-driven power plants in parallel with low capacity hydro and thermal plants, to the use of ultra violet rays in agriculture, were considered at last month's meeting of the United Nations Economic Commission for Europe at Geneva. Preliminary discussions took place concerning eleven other subjects. Among these were methods of financing rural electrification plants and the study of the various national safety regulations for electrical installations on farms, the latter aiming at the formulation of general recommendations to serve as a possible basis for future installations in the less highly industrialised countries. Vice-chairman of the E.C.E. Working Party was Mr C. A. Cameron-Brown, of the B.E.A.

Another Spanish Order

A leading Spanish manufacturer of iron, steel and aluminium products, Manufacturers Metalicas Madrelenas SA, has placed an order with the Westinghouse Electric International Co., of U.S.A., for a gas turbine power plant, according to Mr J. D. Mickle, general sales manager for Westinghouse.

The complete order, worth $2,000,000, calls for a 5,000 kW generating unit and other electrical apparatus for steel sheet mills at Villaverde, near Madrid. When installed the new equipment would enable the Spanish company to expand its manufacturing operations from a three-day to a six-day work week.

The Export-Import Bank has granted a $1,200,000 exporters' credit in connection with the project. Scheduled to go into operation by the end of 1955, the new equipment will enable the Spanish company to fabricate and install annually 10,000 steel roofs for freight cars of the Spanish National Railways, and to increase its production of welded tanks and other items for Spanish industry.

AFRICA

Better Lighting Wanted

Salisbury City Council, Southern Rhodesia, is considering the modernisation of its street lighting. According to a report of the city electrical engineer, it would cost about £900,000 to provide adequate street lighting in the municipal area. He suggests that a capital expenditure of £20,000 should be allocated for such work in the first year, and thereafter a minimum of £15,000 a year should be provided. The Public Works Committee has asked the city treasurer and the city electrical engineer to investigate methods of financing such work and to submit a joint report.

PAKISTAN

A New Plan

The sum of Rs. 50 lakhs will be spent on the extension of electric power in Bahawalpur State, Pakistan, in the next five years. According to the proposed 5-year development programme Bahawalpur, Chistian, Harunabad, Hasilpur, Sadiqabad, Liaquatpur, Uch Sharif and Zahirpur, will be electrified. The local capacity of the power houses at the State Capital will also be increased. The plan has already been sent to the Planning Board of the Central Government. Two power stations of 225 kW capacity each have already been completed at Chistian and Bahawalpur and a 500 kW a.c. generating set has been installed at Baghdad-ul-Jadid this year.

More Work

Construction work is shortly to be resumed on the Karnafuli hydro-electric and irrigation project in East Pakistan. All efforts are to be concentrated on the task of building the main dam, the power house, spillways and navigation locks. The dam, now to be built at Kaptai, is to be 140 ft high above the river bed and 2,000 ft long. The spillways will have a discharge of 525,000 cusecs. Three 40 MW generators are to be installed in the power house, which will have provision for the addition of a fourth set at a later date. Under the project, 2,500 pumps will be installed for drainage and irrigation. The Karnafuli, one of the most important rivers in East Bengal, inundates each year about 465 sq miles in its lower reaches. The proposed dam will not only protect the affected areas from recurring floods but will also provide the Province with cheap electric power for its industrial progress.

AUSTRALIA

Small Supplies

In the scheme of the State Electricity Commission of Queensland for providing power in the remote townships, a new "packaged" generator has been put into operation at Yuleba, a township with a population of 471, situated some 280 miles west of Brisbane. In the last three years the State Electricity Commission has designed, planned, constructed, and placed in commission electricity schemes for 18 small western townships. Similar schemes are well in hand at Capella, Injune, Bluff, Wyandra, Normanton, and Irvinebank.

Amalgamation Rejected

The suggestion that the Southern Electric Authority should take over the Brisbane City Council's electricity undertaking (which we reported on 23 Dec.) has been termed ridiculous by the Lord Mayor of Brisbane, Alderman Roberts. He said that in any unification both undertakings should be taken over by a board formed under the State Electricity Commission. In the unification of electricity in south eastern Queensland, there was only one body that should be considered, and that would be a South East Regional Electricity Board formed by taking over both the Council's undertaking and S.E.A., he declared. It had been suggested that the Council's electricity undertaking could be taken over by another body by assuming responsibility for its electricity loan debt (at 30 June last this was £12,255,451), but in his view that indebtedness represented only a part of the value of the electricity assets. He wondered how much the S.E.A. would be prepared to pay the citizens of Brisbane for their very valuable asset. The Council supplies electricity in the 375 sq mile metropolitan area, except the inner city and South Brisbane which is in the hands of the S.E.A.

More Loans

The sum of £192,000 is being loaned to the Wide Bay-Burnett, Capricornia, Townsville and Cairns Regional Electricity Boards by the State Electricity Commission of Queensland. The loans are to be made from the proceeds of the Commission's loans and are to be expended on electrical development in the areas of the Regional Boards during the current financial year.

Underwater Cable

Two 33 kV cables are to be laid by the Brisbane City Council from Tennyson power house across the Brisbane River to Long Pocket to supply electricity to north-western suburbs. The cables will be laid in a trench in the bed of the river which will be dredged by the Harbour and Marine Department at an estimated cost of £2,000.

FAR EAST

Japan Advancing

Two new generating plants along the Tadami River, in Fukushima Prefecture, Japan, were inaugurated recently. The capacity of one of the stations is 42,600 kW and of the other, 52,000 kW. These raise the total generating power of plants along the Tadami River to 501,300 kW. The two stations are the last of a group constructed in the lower section of the river as a part of the immense electric power resources development project. Construction of similar plants higher up the river is to commence shortly. One of these, the Tagokura power station, is to have an installed capacity of 150 MW and is scheduled for completion by Dec., 1957, while another, the Okutadami, will be of 225 MW capacity and is to be operating late in 1958.

Supplies for small villages

Remarkable progress has been made in the three-year rural electrification programme for Formosa. The scheme was started in July, 1953, and when it is completed next June a total of 50 villages in Formosa will have received an electricity supply. The programme was sponsored by the Taiwan Power Co. with the co-operation of local consumers. It has already benefited over 6,680 householders in 108 remote villages.

Personalities IN THE INDUSTRY

The London Electric Wire Co and Smiths, Ltd., and its associated companies announce the appointment of **Mr M. B. Bates** as manager of their Nottingham branch, in succession to **Mr J. Atherton.** Mr Bates has been with the company for 19 years.

Mr J. B. Scott, sales director of Crompton Parkinson Ltd., left this country on 4 Jan. for an extensive tour of the C.P. overseas organisation in the Far East. He will be away for between 10 and 12 weeks, during which time he will visit the company's branches and agents in Burma, Ceylon, India, Malaya, Pakistan and Thailand. It may be recalled that Mr Scott's last business trip abroad—to Russia eleven months ago—accomplished much in opening up new overseas markets for the company's products.

Several names of electrical interest are included in the list of members of the six area boards set up by the British Transport Commission as from 1 Jan. A member of the Southern Board is **Mr K. Preston,** chairman and managing director of J. Stone and Co., (Holdings) Ltd., while **Mr A. Chamberlain,** a director of Tube Investments Ltd., and **Capt Hugh Vivian,** a director of Associated Electrical Industries Ltd., are members of the Western area board.

Mr C. E. Lander, second assistant commercial officer in the Tees sub-area of the North-Eastern Electricity Board, at Thornaby-on-Tees, has been transferred in a similar capacity to the Board's headquarters at Newcastle-on-Tyne. His successor at Thornaby is **Capt W. J. Knowlson.**

Having reached the normal retiring age, **Mr G. R. Tyler** has relinquished his position as manager of the Maritime Division of Marconi's Wireless Telegraph Co., Ltd. He is, however, continuing his work for the company as their representative in West Africa. Mr Tyler has been succeeded as manager of the Maritime Division by **Mr B. G. H. Rowley,** M.A.(OXON.), A.M.I.E.E., formerly the company's technical representative in U.S.A. and Canada. Mr Rowley was educated at Alleyn's School, Dulwich, and New College, Oxford. On the outbreak of the war he was first engaged on radar development work for the Royal Navy at H.M. Signal School and then on radar duties with the Home Fleet. In 1942 he was for a short period attached to the U.S. Navy for radar liaison duties in the North Atlantic, and was later appointed to the staff of the British Admiralty delegation in Washington, a post which he held until the end of the war. After the war Mr Rowley, who then held the rank of Lieutenant-Commander, continued with the British Joint Services Mission in America as staff radar officer, until joining Marconi's in 1950 as U.S. technical representative stationed in New York.

Mr W. C. Thomson, B.SC., A.M.I.E.E., A.M.I.MECH.E., has been appointed assistant chief engineer (operation and maintenance) to the South West Scotland Electricity Board. Educated at University College, Nottingham, and serving a postgraduate apprenticeship with the B.T.H. Co. at Rugby, Mr Thomson joined the Northampton Power and Light Co. in 1939 as an assistant technical engineer. After war service he took up a similar post with the Clyde Valley Electrical Power Co., and at vesting day was appointed senior assistant engineer (technical) in the Board's Lanarkshire subarea, which he has held till his present appointment.

Mr F. B. Duncan has relinquished the position of deputy managing director and has been appointed vice-chairman of Murphy Radio Ltd.

Mr A. R. Mathias has been elected a director of H. J. Enthoven and Sons in place of **Mr R. T. de Poix,** who has resigned from the board.

Station superintendent at Cowes (I.o.W.) power station, Southern Division, B.E.A., since May 1951, **Mr S. C. Riggott,** A.M.I.E.E., A.I.MECH.E., M.INST.F., has been appointed to a similar position at the Division's Portsmouth generating station. A native of Derby, Mr Riggott was educated there and at Nottingham University College, being then apprenticed to the L.M.S. Railway. From 1930 to 1938 he was at Derby generating station, first as chemist and then as assistant to the boiler house superintendent; subsequently he was chemist and combustion engineer at Thorpe generating station, Norwich, until 1941, when he was appointed combustion engineer at Roath power station, Cardiff. He became deputy station superintendent there in May 1948, holding that position for three years until going to Cowes.

Simon-Carves Ltd Power Plant Department announce that **Mr J. D. Knox** has been appointed to take charge of their London office at Simon House, 6 Stratton St, W.1, as from 1 Jan. Mr Knox has been with Merz and McLellan, the consulting engineers, for the past eighteen years, operating from the Newcastle-on-Tyne and Esher offices.

The **Rt. Hon. Thomas Johnston,** chairman of the North of Scotland Hydro-Electric Board, and **Sir Hugh Mackenzie,** deputy chairman of the Board, whose terms of office expired at the end of 1954, have been re-appointed for a further period by the Secretary of State for Scotland. The latter has also re-appointed for a further term three members of the Board, **Mr William Leonard,** J.P., **Treasurer G. R. McIntosh,** C.B.E., J.P., and **Mr A. I. Mackenzie.**

The **Rt. Hon. T. Johnston,** C.H., LL.D., J.P., F.E.I.S., chairman of the North of Scotland Hydro-Electric Board, and **Sir Hugh Mackenzie,** C.B.E., deputy chairman of that Board, are to receive the freedom of Inverness at a ceremony which will probably be held in March. Sir Hugh Mackenzie was Provost of Inverness from 1934 to 1945.

Mr Eric Dymond, A.M.I.MECH.E., A.M.I.E.E., A.F.R.AE.S., who resigned from the board of directors of Sangamo Weston Ltd. some two years ago after 28 years with that company, is leaving England on 15 Jan. for a tour of indefinite duration in the United States and Canada. Mr Dymond still retains his chairmanships of Two Way Talkie Ltd., and Neltic Ltd., and has been engaged in

Mr B. G. H. Rowley

Mr S. C. Riggott

Mr Eric Dymond

a technical advisory capacity with various companies. His forwarding address is: c/o Bankers Trust Company, 455 Park Avenue at 57th Street, New York City.

Now visiting Britain is **Mr C. W. O. Turner,** engineer-in-chief of the New Zealand Ministry of Works, who for many years has been closely associated with hydro-electric power projects there. The principal reason for his visit is the recruitment of more professional engineers for such work. Mr Turner came here via the U.S.A., where he inspected hydro-electric works, and he expects to return to New Zealand in a few weeks' time via Italy and Switzerland where he will also study similar schemes.

Mr G. K. Paton, M.I.E.E., M.AMER.I.E.E., a part time member of the Merseyside and North Wales Electricity Board, retired from that post at the end of Dec. on completion of his term of office. Mr Paton has been closely associated with electricity supply developments in North Wales for nearly fifty years. Prior to nationalisation of the industry he was a director of British Power and Light Corporation Ltd., of Electricity Distribution of North Wales and District Ltd., and of the North Wales Power Co., Ltd., for many years. He originally joined the latter concern in 1906 after early training with Bruce, Peebles and Co. From 1918 to 1929 he was chief electrical engineer of Aluminium Corporation Ltd., at Dolgarrog, and afterwards he was engineer and manager of the North Wales Power Co. until 1939.

Mr A. W. Gostt and **Mr W. A. Kimber,** who joined Philips Electrical Ltd—then Philips Lamps—together in Dec. 1929 have completed 25 years service with the firm. To mark the occasion, celebration luncheons were held, and the presentation of cheques and inscribed watches was made by **Mr G. Hofman,** managing director. Mr Gostt has been sales manager (technical) of the Lighting Division since 1952, while Mr Kimber has been manager of the Tungsten Lamp Department since 1950.

Mr A. Rutenberg, Mr J. Shapiro, Mr J. Pelled and **Mr M. Makleff** have been appointed directors of the Jerusalem Electric and Public Service Corporation, Ltd. This follows the acquisition by the Palestine Electric Corporation Ltd., of over 90% of the issued Israel share capital of the corporation. **Mr Hugh G. Balfour, Mr D. C. Brook, Sir Cuthbert M. Headlam** and **Mr D. S. Warren** have all resigned from the Board of Jerusalem Electric and Public Service Corporation Ltd.

Following the appointment of **Mr T. A. Lindsay** as executive vice-president of Phillips Electrical Co. (1953) Ltd., the Canadian subsidiary of British Insulated Callender's Cables Ltd., (as we reported on 18 Nov.), changes in the sales organisation of the former concern are announced. **Mr F. W. Barnhouse,** B.SC., is appointed general sales manager of Phillips, and will be assisted by **Mr E. M. Lloyd,** as marketing manager, and **Mr D. C. Brazier,** as sales manager. Mr Barnhouse joined Phillips as sales manager a year ago, having previously been manager of the wire and cable section of the Canadian General Electric Co. Mr Lloyd was with B.I.C.C. for many years before joining Phillips in 1953; while Mr Brazier has been with the company for more than ten years.

Mr J. W. Rodger, M.I.E.E., managing director of Bruce Peebles and Co., Ltd., has been elected president of the Scottish Engineering Employers' Association.

At the annual general meeting of the Birmingham branch area of the E.I.B.A. the following officers were elected for the coming year: president, **Mr R. L. Batley,** O.B.E., A.M.I.MECH.E.; chairman, **Mr S. J. Vaughton;** hon. treasurer, **Mr H. J. Bick;** and hon. secretary, **Mr F. Williams.**

Mr H. L. Briggs, general manager of Winnipeg's City Hydro undertaking for the past three years, is resigning in order to take up an important post with the British Columbia Power Commission, we learn. Mr Briggs has served with the City Hydro electricity undertaking for 26 years, successively holding the posts of operating engineer, assistant to the chief engineer, and in 1944, chief engineer in charge of system operation. He was made assistant to the general manager four years later, and general manager in Jan. 1952. In 1949 he made a notable contribution to discussions on Manitoba's power difficulties by preparing a detailed study of the Winnipeg and English river systems.

The following senior members of the staff of Kennedy and Donkin have been appointed as consultants to the firm with effect from 1 Jan.: **Mr J. North,** B.A., M.INST.C.E., **Mr M. V. Ratcliffe,** B.SC.(ENG.), M.I.E.E., and **Mr F. J. Hutchinson,** M.ENG., M.I.MECH.E., M.I.E.E.

Mr E. B. Rogers, manager of the Service Department of the Valve Division of Mullard Ltd, retired from his position on 31 Dec. last. Mr Rogers, who has been with the Department for 28 years, will be succeeded by **Mr F. E. Debenham,** who has been deputy manager for the past three years. Mr Debenham, who has been associated with the Mullard group of companies since 1929, spent some of his time with the Valve Sales Department before the war and was, for some years during the late war, production manager at the Mullard Valve Factory, Blackburn.

After 40 years with Dunlop Ltd., **Mr F. Walker,** O.B.E., M.I.MECH.E., chief engineer at Fort Dunlop, retired last week. During the war and afterwards he served either as member or chairman of the Midland Regional Fuel Efficiency Committee, on the Ministry of Fuel and Power's central committee, and the British Rubber Manufacturers' Fuel Efficiency Committee. Mr Walker has initiated and carried through many of the developments which have kept Fort Dunlop well in the forefront of engineering efficiency. He re-organised steam generation and distribution and also electricity supply to meet the huge demands of both war and peace. To meet developing production requirements he installed an auxiliary boiler plant and, in the electricity field, an 11 kV ring main with its ancillaries.

Mr N. J. Hulbert, M.P., has resigned from the boards of the British Thomson-Houston Export Co. and the Metropolitan-Vickers Electrical Export Co.

Sir Hugh Warren, D.SC., M.SC.(ENG.), M.I.E.E., M.I.MECH.E., F.INST.P., managing director of Associated Electrical Industries, Ltd., has retired from that position as at 31 Dec.

Mr A. de M. Browne, B.SC., A.R.C.SC.I., managing director of the Hackbridge and Hewittic Electric Co., Ltd., has recently been appointed chairman of the company. Mr Browne, who received his education at Blackrock College, Dublin and Royal College of Science, Ireland, joined the Hewittic Electric Co., Ltd., as technical development engineer in 1924, became chief engineer in 1930, and manager in 1936. He was appointed director in 1939 and, concurrently, sales director of Hackbridge Electric Construction Co., Ltd., in 1941, becoming director of both companies after their amalgamation in 1947. He is also a director of the New Switchgear Construction Co., Ltd., and president of the Hackbridge and Hewittic Electric Co. of Canada, Ltd.

Formerly with Cantie Switches Ltd., **Mr B. J. Randall** has joined the sales staff of Electro Mechanical Manufacturing Co., Ltd., at Grand Buildings, Trafalgar Sq, W.C.2.

Mr H. D. Drysdale has been appointed chairman of Morphy-Richards Ltd., in place of **Mr George Wansbrough** who has resigned from the Board for personal reasons. Mr Drysdale joined the board last Nov.

OBITUARY

Mr W. Mills

Mr W. Mills, a director, and former secretary of Brook Motors Ltd., died on 25 Dec. He joined E. Brook Ltd., two years after the foundation of the firm and became secretary shortly afterwards. He held that position for 45 years, resigning last February on account of failing health, but he remained a director, having served on the board for 41 years.

Mr J. P. Rice, manager of the British Thomson-Houston Co's Lamp and Lighting Depot at Blackpool, has died, aged 61. He had served with the company since 1932.

Mr Edward S. Darling, nephew of Sir William Y. Darling (chairman of Bruce Peebles and Co.), died in Kampala on 30 Dec., aged 28. He had been engaged in the erection of distribution lines in Uganda. Earlier he had served with Bruce Peebles and Co.

Mr G. H. Hanna, district engineer of the Cookstown branch of the Electricity Board for Northern Ireland for over 20 years, has died.

Mr Howard Foulds, F.C.I.S., for 26 years secretary of the former Callender's Cable and Construction Co., Ltd., has died, aged 86.

Mr A. S. Tait, former president of the English Electric Co. of Canada Ltd., has died. He joined that concern in 1934, became president in 1942 and chairman of the board in 1947.

Mrs Fraser, wife of John Fraser, Press Officer to the British Electrical Development Association, died on 30 Dec.

Lt-Col Hugh P. T. Lefroy, D.S.O., M.C., A.M.I.E.E., a pioneer in wireless development during the first world war, has died. For a time he was the principal research officer in wireless for the Royal Air Force; he designed the first radio equipment which made communication between aircraft and the ground.

Mr J. E. Chamberlain, chairman and joint managing director of Switchgear and Cowans Ltd., died on 31 Dec., aged 63. He had been managing director of the firm since it became a public company in 1936, and he was largely responsible for the expansion of its activities and of those of the subsidiary companies. Many of his friends in the industry will remember him during his association with the Hewittic Electric Co., Ltd., from 1923 to 1936, when he pioneered the use of the glass bulb mercury arc rectifier in this country.

NEW LITERATURE

Television Receiver Servicing Vol. 1: Time Base Circuits

by E. A. W. Spreadbury, M.BRIT.I.R.E.

TO the radio service engineer, the opening of a television transmitter in his area comes as a mixed blessing since he now has to familiarise himself with a wealth of new techniques and deal with apparatus which, in only one of its various sections is comparable in size and complexity with a radio receiver. To his aid comes this valuable book, which sets out to provide the radio engineer with a description of the operation of each section of the receiver and to show him whether it is receiving, and supplying, the correct signals. The book is not a catalogue of known faults with short cut remedies, and since it is addressed primarily to experienced radio service engineers, it assumes the principles of that subject are already well known.

As a reference manual for television receiver servicing it is excellent, the text being clearly written, in a language the service engineer will understand. As the first of two volumes, this book is concerned solely with time base circuits, its companion dealing with receiver and power supply circuits being under preparation. It introduces the subject by discussing the methods of attack when the engineer is faced with a blank screen on switching on the receiver. From this start, it considers the steps required to obtain a raster, or scanned patch, on the screen; synchronising and its associated topics of interlace, and sync. separation, with a chapter devoted to flywheel synchronisation. Supplies for the cathode ray tube are also dealt with. Published by Iliffe and Sons, 305 pages, 8½ in. by 5½ in. Price 21s.

Electrical Commercial Catering Handbook

COMMERCIAL electric cooking dates back to 1894, when the food served at an I.E.E. banquet was largely cooked electrically. Since then, electrical commercial catering has become firmly established on its own merits, with a wide variety of well-designed equipment, constructed from high quality materials, now readily available. To guide the salesman of such equipment, and its user, E.D.A. have produced a useful and versatile handbook dealing succinctly with design, installation and maintenance of such equipment. The needs of the salesman are particularly well met by a helpful chapter discussing kitchen planning, whilst the inclusion of some discussion of energy consumption is particularly valuable. Although the bulk of the book is concerned with general equipment for commercial catering, many will find the mention of such specialised applications as bread baking and fish frying a useful feature. The section on maintenance is largely confined to suggestions for the successful operation and upkeep of the equipment which are to be carried out by the user. Published by the Electrical Development Association, 2 Savoy Hill, W.C.2, 66 pages, 7 in. by 4½ in. Price 5s.

The Physics of Experimental Method

by H. J. J. Braddick, PH.D.

AS human knowledge of physical facts and laws grows more extensive, the methods of experiment used in physical experiment become yearly more varied and the student finds himself with less and less time for not only investigation itself, but for choosing methods and planning details of his investigation. To meet the latter shortcoming, this book provides an admirable exposition of the methods of experimental physics with three special features to commend it to advanced students in a much wider range of subjects. The first is the emphasis on the fundamental physical principles of measurement, secondly comes equal emphasis on the importance of the properties of key materials in such measurement, whilst there is the practical feature of limiting the scope of the book to subjects reasonably mastered by the advanced student. Not only, however, will the student find the book a valuable aid, for the increasing part played by precise physical measurement in industrial product claims for it a place in the industrial scientist's bookshelf.

Initially, the work discusses errors and treatment of experimental results, with a useful appendix to this section providing a guide to some of the calculations suggested in the section. From this stage, the mechanical design of instruments and apparatus is considered, leading logically to the third section on materials used in construction. Individual branches of physical measurement are then considered under the headings of vacuum technique, electrical measurement, electronic measurements, optics and photography with final chapters discussing the natural limits of measurement and nuclear physics techniques. Published by Chapman and Hall, 404 pages, 8½ in. by 5½ in. Price 35s.

Electric Accumulators

Ed. by Bernard E. Jones.

ANOTHER in the well-known series of Cassell work handbooks, this one sets out to deal, from a practical aspect, with all the problems associated with care and maintenance of accumulators from the smallest, to those used for traction purposes. After preliminary chapters on basic electric theory and the working principles of accumulators, the actual constructions of various types are discussed. Erecting and starting of accumulator plant for country houses or similar installations, and the management and maintenance of these equipments receives detailed treatment which is supported by tables and illustrations. Theoretical considerations of charging and methods of carrying out this operation precedes sections dealing with typical layouts when power is obtained from d.c. and a.c. sources respectively. Some of the best known and typical lead-acid batteries are described showing points of difference in design and construction and then follows a chapter on alkaline batteries. A very short section describes the small celluloid-cased accumulators which are used in radio sets. Published by Cassell and Co., Ltd. 7½ in. by 5 in., 158 pages. Price 4s. 6d.

PROBLEMS AND PRACTICE

In Engineering

Inductance Effects

TWO recent experiences indicate the serious nature of the effect of inductance in power circuits can have. The first concerned a three-phase motor of some 50 h.p., which, it was reported, would not start. On testing the supply voltage at the motor terminals, some 116 V was found to exist, when the motor was on load, but normal voltages obtained when the machine was switched off. It was estimated that insufficiently-sized cables had been installed to allow for resistive voltdrop, but further inspection revealed that three single-cored steel armoured cables had been installed on a 50 yard run. The high inductive effect of these cables was responsible for the motor failing to start. They were duly replaced by a 3-core armoured cable.

The second experience relates to one of the "outlet" breakers situated in a ring-main feeder on a 132 kV o.h. line which tripped for no apparent reason or fault. However, at the same instant a fault had occurred on an 11 kV o.h. line running parallel to the 132 kV line for some 11 miles. The fault in the latter had induced fault current into the 132 kV line.

It was found also that the 132 kV line had no line reactors in circuit, hence the fault current flowed unchecked round the ring-main, tripping this particular breaker.—*R. T. C.*

Electrode Water Heating

THE full load current of a 60 kW, 3-phase 400 V electrode water heater, installed for several years in a local cinema, had decreased from 88 amps to 22 amps during a period of one week-end. The town water supply was fed to the heating system via a ball tap and cistern installed in the roof. Eventually the trouble was found to be due to a leaking joint in a heating pipe which, incidentally, was situated directly over a waste pipe. The slight hissing sound made by the town water passing into the cistern gave the clue which led to the ultimate discovery of the leaking joint.

After the necessary repairs were completed a solution of common washing soda added to the water brought the full load current up to normal.

On another occasion the full load current taken by a new 30 kW, 3-phase, 400 V electrode steam raiser, installed in a local flour mill, could not be increased above 5 amps. This was due to the condensate water from the main-drive steam engine being used in the steam raiser. It was suggested that a sufficient quantity of common washing soda be dissolved in the water until full load current was obtained.

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Several months afterwards a complaint was received that the fuses would not "hold in," even with the electrode shields in the minimum load position. On opening-up the steam raiser it was found that two of the three moveable electrode shields which appeared to be made of some form of varnished paper, had been partially destroyed apparently by excessive burning.

After a good deal of time and trouble had been expended in asking various questions it was elicited that caustic soda had been used instead of common washing soda because "none of the latter had been at hand."—*E. A. Robbins.*

Tracking Fuse

IN "Problems and Practice" (23 Dec. issue), Mr H. T. Williams ascribes unbalanced and faulty operation of a 3-phase hoist motor to tracking across a blown h.r.c. fuse in the main supply.

I think this is extremely unlikely—I have never yet found any h.r.c. fuse to be guilty of "tracking" when blown. The clue to the probable explanation is given by his voltmeter readings, and statement that "other plant fed from this supply was apparently running satisfactorily." The plant running was acting as pilot generator in a "Ferraris-Arnos" artificial 3-phase system, and without any condenser correction, would give the voltages, approximately, that he obtained (170 V on the "dead" phase). This system is widely used where only a single phase supply is obtainable, as it enables standard 3-phase motors and control gear of the single squirrel cage types to be used.

The first motor to be started up is called the pilot motor and having fairly heavy capacitor correction on the pilot phase. This capacitance gives the motor its starting torque. Thereafter simple 3-phase motors, usually smaller than the pilot, can be started up either star-delta or direct on line.

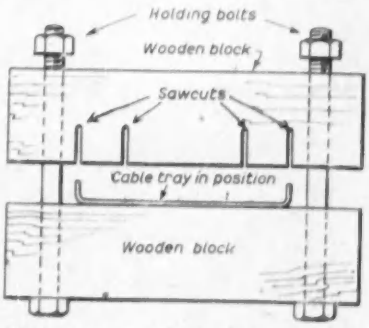
Two points need observing. Care is required in selecting the pilot motor and its capacitor—a slip-ring motor is usual and the voltage on the starting and correcting capacitor must be closely watched. I have known this reach a 1,000 V between phases during an initial test when starting the 1st squirrel cage motor (but once set up, the system is trouble free). Secondly, it is necessary to use larger motors than would be the case if an ordinary 3-phase supply were available —often up to 40% larger.

Among other points emerging from his note is use of neon lamp testing for blown fuses—I have found this completely unreliable and misleading. A film of moisture (even slight) or the film of sputtered metal from a blown fuse gives a sufficient leakage current to light the average small neon lamp—particularly the "screwdriver" or pocket test neons. Again returning to h.r.c. fuses, these do not suffer from deterioration. A surge of some kind (magnetising transient of a transformer or motor stator possibly) is to blame.

In passing may I bear out the remarks of an old friend of mine—Mr J. E. Hooper (Readers' Views last week) regarding the need for inspection and mintenance of isolating switches. More motors are burnt out through taking these for granted, than many people realise. Which brings me to one last point, both the above experiences point to the need for reliable and adequate anti-single phasing protection of 3-phase equipment; still today very often poor in new equipment.—*J. Gore.*

Bending Wiring Trays

FOR ship wiring and other installations where surface wiring is used it is usual to clip the wires to a thin sheet iron framework known as a tray. This can be set over projections in much the same way as conduit provided a suitable setting block is used, but the bending is by no means easy as the tray may be up to twelve inches wide and has a lip



Wood blocks used to provide a means of bending cable tray

on each side. The best way to set is by two blocks of wood of a suitable size which can be clamped together and has saw cuts to take the lips of the tray as shown in the sketch.—*W. E. W.*

Equipment for Industry

Voltage Regulators for TV Vehicles

IN certain applications it is necessary to have a source of constant voltage maintained at a preset value, despite mains fluctuations. FOSTER TRANSFORMERS LTD., South Wimbledon, S.W.19, have for many years been producing transformer equipment for this purpose, and recently they have supplied PYE RADIO LTD., with automatic voltage regulators for installation in outside television broadcast vehicles which are being widely used overseas. These regulators have been designed to give three independently controlled single-phase outputs to supply transmitters and ancillary equipment with a constant voltage, which is said to be maintained within ±1% with a mains varying from −37 to +9% of the nominal value.

Basically the units consist of a main transformer with multiple tappings on the primary connected to a tapping switch. An electronic device connected across the output terminals detects any change from the preset voltage and energises one or other of the fields of a split-field series motor which drives the tapping switch to readjust the secondary potential. The electronic device depends for its operation on the difference between a d.c. voltage proportional to the output and a reference voltage, the balance being fed to one or other of a pair of thyratrons which are arranged in the motor field circuits. Although in this instance, only one type of regulator is considered, the firm manufacture many types to suit individual specifications, and where electronic control is undesirable, a device incorporating magnetic amplifiers may be supplied. High efficiency combined with reliability is the aim for all these products and a particular advantage of this pattern of regulator is that minimum wave-form distortion may be expected.

These regulators are being used in outside television broadcast vehicles

Improved Neon Lamps

AN improved range of colour glow neon indicator lamps is now being manufactured by PHILIPS ELECTRICAL LTD., Century Hse, Shaftesbury Ave, W.C.2. Advantages claimed are that the power used is only 0·5 W, which results in cooler running than with previous designs, and modifications that have led to improved long life and resistance to vibration characteristics. The lamps are already being used in CO_2 safety equipment at two London Electricity Board substations. In the 100/130 V and 200/260 V ranges, red, green and amber glow lamps sell at 6s. each and plain lamps cost 4s. each.

Balance Wear Reduced

INTERESTING use is made of a synchronous motor in its latest application to analytical balances. The main source of trouble with such instruments is that, either due to normal wear and tear, or due to rough handling, the knife edges are often damaged. In a new device, the "synchro-release" mechanism, introduced by STANTON INSTRUMENTS LTD., 119 Oxford St, W.1, the actual operations of releasing or arresting the balance are taken over by a synchronous motor. Suitable for fitting to any of the firm's projection reading balances, the device is said to be foolproof and reliable, and to enable unskilled labour to be employed on this hitherto delicate operation. In addition the speed of weighing has been increased.

The mechanism consists of a low voltage synchronous motor with a built-in sealed gear unit, which is brought into action by a micro-switch fitted to the balance release shaft. After moving the release knob through a few degrees only, the motor takes over and beam movement is controlled to a slow rate. The device is arranged to operate on the arrestment movement, since tests in Stanton laboratories are said to have shown that this is as likely to cause damage to knife edges, as careless release.

Low Frequency Transformer Range

TRANSFORMERS which operate on frequencies as low as 2 c/s, call for special techniques in their design and construction. AVIS AND BAGGS LTD., Gosbrook Rd, Caversham, Reading, are a firm who specialise in the manufacture of these small components, which are intended primarily for geophysical applications and have recently announced a range which is now in production. Features common to all sizes are that they have balanced windings, internal screens and heavy mumetal cases which tend to reduce stray pick-up to a low level. All units employ hermetic sealing and vacuum-impregnated windings. Termination is by means of "Corundite" insulators. When being used as an output transformer, with an input of 1 V at 10 c/s a primary inductance of 3,600 Henrys is claimed for one unit. This being achieved with a frame size having a volume of 20 cu in. and a total weight of 10 lb.

Gas Attachment for Soldering Iron

BEFORE a good job can be made of soldering large masses of metal, it is usually necessary to preheat the whole casting or assembly. Alternatively, local heating may be applied by use of a gas jet or blow lamp with the soldering iron used simultaneously. The disadvantages of these two methods are, however, that in the case of the former it is often inconvenient to remove the assembly to a furnace, and the latter is a two handed job involving complications when flux or extra solder are required. MULLARD LTD., Century House, Shaftesbury Ave, W.C.2, are now manufacturing a device, suitable for attaching to their ultrasonic soldering iron, and which is designed to overcome these difficulties. This combined equipment directs a gas jet on to the area where soldering is in progress and requires only one hand for support, giving obvious advantages. The attachment is suitable for fitting to any of the range of ultrasonic soldering irons and is said to be easily fixed. A tap controls the flow of gas for the flame. Price is £6.

The attachment is clearly shown, mounted on a Mark II ultrasonic gun

E.L.M.A. announce Price Drop

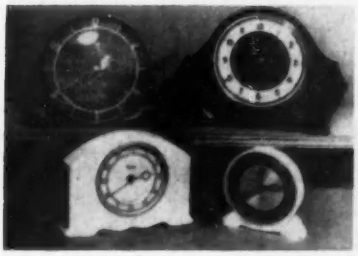
PRICE reductions for the de luxe warm white fluorescent lamp (normal start) are announced on behalf of its member companies by the ELECTRIC LAMP MANUFACTURERS ASSCCIATION.

As and from 1 Jan. the prices are as follows:

Lamp Wattages	Old list price	New list price
80 W 5 ft	14s. 6d.	13s. 0d.
40 W 4 ft	13s. 0d.	11s. 9d.
30 W 3 ft	12s. 3d.	11s. 0d.
40 W 2 ft	12s. 3d.	11s. 0d.
20 W 2 ft	11s. 9d.	10s. 6d.
15 W 1½ ft	11s. 0d.	9s. 9d.

These prices are exclusive of purchase tax. All lamps indicated above are available in instant start types at 1s. each list extra.

New GEC Clocks



FOUR new Genalex synchronous electric clocks have been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway W.C.2. These comprise three mantelpiece clocks and one luminous alarm clock.

Our photograph shows top left the DM 1090 clock in oak price £3. 10s. plus 11s. 7d. purchase tax; top right is the DM 1091 clock in walnut price £4. 5s. plus 14s. 1d. purchase tax. On the bottom row are the DM 1029 clock in ivory price £2, plus 6s. 11d. purchase tax, whilst bottom right is the DM 1002 L alarm clock price £1. 16s. 3d. plus 6s. 3d. purchase tax.

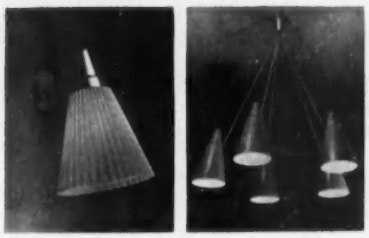
Crockatts adjust Sander Price

INSTALLATION of new machinery and increased production resulting in greater efficiency throughout the factory has made it possible for W. CROCKATT AND SONS LTD., 64 Darnley St, Glasgow, to reduce the price of their floor sanding machine from £140 to £125. This price reduction becomes effective immediately.

"Cone" Range Extended

CREATING a stir when they introduced their "spider" fitting some time ago, CONE FITTINGS LTD., 9 Rosemont Rd, Hampstead, have again hit the headlines with a greatly enlarged range of fittings.

Bearing the same ingenious "touch" in style the new fittings are literally extensions of the former designs. The wall lamps available include the simply installed hanging spider type with aluminium shade caps and legs anodised warm brass and washable acetate shades in white, ivory or apricot or in spun aluminium enamelled in citron, terra cotta, peacock blue, french grey, dark blue, grey, black and white. Other versions of this type of fitting include models with a different mounting plate and suspension as seen in our illustration. There are now four pendant fittings using acetate and spun aluminium shades in three and five light types. An acetate ceiling shade and a table lamp incorporating this shade complete the range.



Left is the C.P. wall-light with acetate shade and new wall plate, and right the 5.S. pendant with the aluminium shades

For the Electrical Trade

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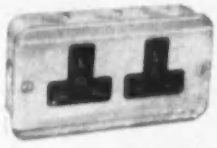
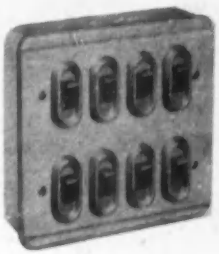
MK 1955 Accessories

INCLUDED in the 1955 catalogue of accessories by MK ELECTRIC LTD., Wakefield St, Edmonton, N.18, are a number of recent additions as detailed below. List 651 is a new rubberclad fused plug for 13 amp ring main usage. List 850 and List 733 are two gang surface metalclad and flush brass plate socket-outlets. (The former is of the industrial type.) 3-pin pilot lamp switchsocket outlets are now listed. No. 2438 is a surface pattern and No. 2440 a flush version of the former. New fused spin box is No. 955 of the surface metalclad type and new in switches are the range of surface metalclad a.c. only switches 5 amp rating in 1 gang up to 8 gang patterns. In these the switches are mounted on a removable grid allowing ample wiring space and visibility before the lid is replaced on the box.





Top is the List 850 2 gang socket-outlet and right is the List 3768 8 gang surface metalclad switch

TRADE PUBLICATIONS

TIN ALLOYS.—"Improved aluminium-tin bearing alloys" and "Some aspects of turning by immersion processes" are two new booklets issued by the Tin Research Institute, Fraser Rd, Perivale, Greenford, Middx.

ELECTRONIC RESEARCH GEAR.—Copies of the "Short Catalog" issued by Bruel and Kjaer of Denmark for whom Rocke International Ltd., 59 Union St. London, S.E.1, act as London office, are available freely to all enquirers.

RADIATORS.—Dimplex Ltd., Totton, Southampton, have recently produced a servicing and instruction manual for their oil filled radiators. Supplies are available on request.

INFRA RED EQUIPMENT.—Literature describing the full range of Elstein infra red equipment which they supply is available from P. and R. Electrical Co., 1 Berrymead Gdns, Acton, W.3.

GENERATORS. Latest brochure issued by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is devoted to an illustrated account of the plant for power generation which they have designed and built.

ACCESSORIES. M.K. Electric Ltd., Wakefield St, Edmonton, N.18, have circulated reprints of E.D.A.'s leaflet D.I.1 on domestic electric installations.

ALLOYS. Wiggin Nickel Alloys No. 29 issued by Henry Wiggin and Co., Ltd., Thames House, Millbank, S.W.1, contains features on sheathed elements and the annealing of glass.

CONDENSERS. Special Products Bulletin No. 3 issued by Telegraph Condenser Co., Ltd., North Acton, W.3, features further notes on printed wiring circuits.

TEST GEAR. Airmecs' Televet type 877 test television servicing test and meter equipment is featured in sales literature available from Airmec Ltd., High Wycombe, Bucks, England.

ACCESSORIES. New Catalogue W 910 on Wylex electrical products has now been issued by Geo H. Scholes Ltd., Wylex Works, Wythenshawe, Manchester.

Gas-tight Flue Sealing Equipment

Advantages in Modern Large High Temperature Boilers

GAS-TIGHT sealing has gained importance in recent years due to the higher steam temperatures being used in modern power station generating plants. Many of the materials used in boiler construction operate near their temperature limits and it is thus important to avoid as far as possible thermal shocks which may cause fatigue and possible outages. It is thus important that when large sets are shut down the boilers should be isolated to prevent cold air being drawn in from the chimney draught. It is also important that under short shut-down routines, heat should be maintained in the boiler system during the shut-down period.

The principle of gas-tight sealing of power station boilers is far from new, and has been incorporated in numerous B.E.A. boilers. Metropolitan Combustion Engineering Ltd., of 47 Whitechapel High St, London, E.1, have been carrying out this work for some time.

One of the more important features concerns the sealing of dampers. Most flue dampers must of necessity be designed with wide working clearances which inevitably increase in service due to warpage, misalignment, flue dust and so forth. In by-pass flues, the efficiency of the by-passed plant such as economisers, induced draught fans, dust precipitators and so on is seriously impaired by gas leakage past dampers. This loss may be substantial and is exemplified by a large water-tube boiler where the substitution of a gas-tight curtain instead of a series of louvre dampers in the economiser by-pass, reduced the gas exit temperature from 375° C to 300° C.

Curtain Sealing

Two basic types of Metro-Flex flue sealing equipment are available. The Metro-Flex coiling curtain which is generally designed as an open/shut device for the sealing of large flue cross-sections The curtain equipment incorporates a load carrying curtain composed of suitable metal members and a sealing curtain made from heat-resistant fibrous material. The equipment can be made for the more extensive flue cross-sections and is available for any type of operation—hand, hydraulic and electrical. The flues concerned are generally horizontal or slightly inclined.

For vertical or steeply rising flues, or for the smaller sections is the Metro-Flex Louvre type damper with metallic sealing system. This is suitable for any normal gas pressure differential and for temperatures up to 1,000° F and over. It is designed as a dual-purpose equipment permitting its use for regulating purposes as well as for gas-tight sealing. Hundreds of units of this type are already in use, many of them working under particularly adverse conditions in high dust content atmospheres and gas temperatures of 1,000° C. and more.

In this system the louvres are fitted with edgings of metallic sealing springs which provide a gas tight seal, and due to the "suspended design" adopted they are unaffected by jamming, bearing misalignment and similar troubles. In horizontal flues, a flue dust ejecting system is incorporated which makes the equipment self clearing so that flue dust does not interfere with louvre movement or sealing action. The damper assemblies are composed of fully interchangeable units which can be easily uncoupled and extracted for external servicing and can be replaced by standardised spare units if necessary without any need for the flue to be entered. Thus maximum boiler availability can be maintained.

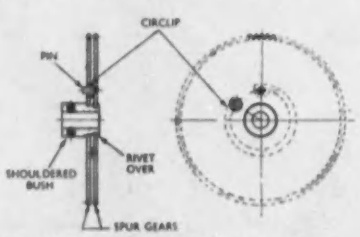
The dampers are generally operated by a motor driven gearing converting the motor rotation into a lateral rod movement which in turn is connected to the louvre cranks. All the dampers of a unit thus move together and are controlled from an operating panel which can be made common to several damper systems.

Preventing Backlash in Small Gears

New System uses "Circlip" Principle for Control

IN the design of spur gearing for small precision mechanisms the elimination of backlash is usually an essential requirement. It is of importance in both the mechanical and electronic engineering fields to designers of servo-mechanisms, radio and television equipment, computers and many varieties of instruments. A conventional method is to use coiled tension springs with their associate anchor pins fixed to the side of the gear wheel. This type of assembly takes up much space, special springs have to be made, and on very small diameter gearing, fitting can be troublesome.

With a view to overcoming these difficulties, a simple anti-backlash device has been devised by the Research Laboratories of The General Electric Co., Ltd.,



Details of assembly of anti-backlash device

occupying no more space than the width of an equivalent spur gear and utilising a standard stock size circlip to provide spring tension.

The assembly is made up of two narrow spur gears with a circlip sandwiched between them. Pins fixed to the wheels pass through the plier holes in the circlip and project through clearance holes in each wheel. This sub-assembly is mounted on a shouldered bush, suitably bored and provided with grub screws for fixing to the drive spindle. One wheel is free to revolve and the other is pushed on and secured by riveting or ring-punching against a shoulder. (This type of assembly has proved suitable for light drives, but if the gear is to take appreciable power, the bush would have to be splined or knurled to secure the fixed wheel.)

The gears are made of thin section material with the necessary holes drilled or punched in position. A pin is riveted to each wheel and the clearance holes should allow for a minimum angular displacement between wheels of approximately two circular pitches. The wheels are similar in shape but the centre holes are of different diameters; one is a running fit and the other a push fit, on the shouldered bush. On assembly with the mating gear, the free wheel is tensioned to give an angular displacement of one tooth.

Any standard circlip can be used, but on the smaller diameter gears where space is restricted, the external type is more suitable. A circlip to give the required tension can usually be selected by trial, but if necessary tension can be reduced by grinding the circlip down to a suitable thickness.

This drive has been used over a range of wheels from 1 in. to 3 in. diameter, but the device is adaptable to a much wider range of wheel sizes.

A refinement can be introduced by making the fixed wheel and bush in one piece and turning a projecting ring on it to locate in a recess on the free wheel which is retained on the bush by means of a circlip. This design obviates any tendency to rocking between wheels, but would only be necessary for high precision work, where extreme accuracy of tooth contact is required.

In the case of a design involving a train of gears, a simplification can be made whereby the intermediate gears are not fitted with circlips, the first gear assembly providing the necessary spring tension for the gear train.

NEWS OF THE WEEK

More Tolerant Views on Overhead Lines

Parks Commission acknowledges Board's Concern for Amenities

BETTER relations between the National Parks Commission, and the electricity supply industry are apparent from the fifth report of the Commission, published recently. The Commission has special responsibilities relating to the preservation of areas of natural beauty, especially where these have been designated national parks, and in the past there have been many disputes about the siting of overhead lines and similar matters. During the year ended Sept. 30, 1953, however, "in the vast majority" of the proposals for electrification (totalling more than 1,000) considered by the Commission, it was possible to assent to the proposals as originally made, or to agree to modifications which lessened the damage to amenities. The Commission explicitly recognises that it is the duty of the various electricity authorities to extend their supplies in the most economical way, and that this must on occasion conflict with amenity considerations. They explicitly recognise that electricity boards are not unresponsive to the claims of amenity, and state that experience shows that a reasonable compromise can be found in many cases.

Various cases are noted in the report in which the Commission claims to have had successes in regard to electricity supply projects. The abandonment of certain schemes for hydro-electric stations in Snowdonia is an example, as is the appointment of a landscape consultant in connection with the North Wales Hydro-Electric Power Act, 1952. "Thanks to the co-operation" of electricity authorities, various overhead lines have been diverted or replaced by underground cables. The recently published B.E.A. hydro-electric schemes for Ffestiniog and Rheidol are being considered by the Commission.

EASTERN BOARD ANNOUNCE INCREASES IN TARIFFS

TARIFF increases to help provide a necessary increase in annual revenue of about £3 millions were announced by the Eastern Electricity Board on Tuesday. There are to be four main alterations with the industrial maximum demand tariff still under examination. Domestic consumers are to pay an extra 6d. per week on the fixed charge in the two-part rates, which represents an increase of about 0·2d. per unit on previous charges. Similar increases in fixed charges have been made in the combined premises and farm tariffs, while in the block tariff, applying mainly to commercial consumers, the unit price of the middle block has been raised from 1½d. to 2d. per unit. These increases are expected to come into force on 1 April.

A warning that the Eastern Board were contemplating raising their tariffs was given in our 9 Sept. issue. The main reasons are said to be increases in bulk supply costs, depreciation and interest charges, salaries and wages, which have risen by some £4¼ millions p.a. since 1952.

Firm to establish School of Electronics

MONETARY awards have been presented to 182 student employees of Automatic Telephone and Electric Co., Ltd., by the management for successes gained in last year's Technological Examinations. Mr J. A. Mason told students at this function that the company were going to establish a School of Electronics where university graduates and others could train in electronics and other electrical subjects.

Mersey Board reorganises District Management

SOME rearrangement in the administrative set-up of their No. 4 sub-area has been decided on by the Merseyside and N. Wales Electricity Board. The sub-area concerned covers the six N. Wales counties and parts of Cheshire, Shropshire and Cardiganshire. Each of the eight districts in the sub-area is to be placed under the supervision of a district manager. It is not intended to alter the boundaries and the posts of district engineer and district commercial officer will remain as hitherto. The districts concerned are Wrexham, Crewe, Rhuddlan, Conway, Caernarvon, Oswestry, Anglesey and Aberystwyth. This area extends over some 4,000 sq miles and the decision was made mainly because of the considerable extension of supplies in recent years.

RADIO AND TV EXAMS.

CLOSING dates for entries for the Radio and Television Servicing Examinations were given by the Radio Trades Examination Board last week. Entries for the Radio Servicing Certificate Examination should be received by the Board at 9 Bedford Sq, W.C.1, by 1 Feb., and those for the Television Servicing Certificate Examination by 15 Jan.

New Wholesale Values Effective from 1 Jan.

THE new provisions which determine the wholesale value of goods in cases where manufacturers deal directly with retailers came into force last Saturday. Manufacturers who sell direct to shops had to add to their price in order to reach a wholesale value on which purchase tax is charged. This was commonly called "uplift" which Customs and Excise have now partially abolished. The concessions were announced originally in the Budget but details had then still to be worked out, and the modifications were issued by Customs and Excise in their Notice No. 79 last Sept. (see our 30 Sept. issue).

Recommendation on Purchasers' Liability for P.T.

REFERENCES to purchase tax on domestic electrical appliances have become more frequent in recent weeks and the trade is at present spending an anxious time wondering whether last January's announcement by the Chancellor of the Exchequer will be repeated in 1955. This wonder has become more marked following the Beaver Committee's pointed recommendation concerning tax on electric fires.

Considerable time was spent in discussing the subject at last week's meeting of the E. Midlands Electricity Consultative Council. One of the council's local committees recommended that the tax should be spread over the full period of hire purchase for appliances costing under £50. It was also suggested that half the tax should be paid with the deposit where articles cost over £50.

The committee endorsed a member's proposal that it should be clearly indicated on future agreements that even if purchase tax on the article concerned was reduced or removed during the repayment period, the purchaser would still be held liable to repay the tax applicable at the time the agreement was signed. The Council accepted the recommendation of its local committee with the proviso that the sum of £50 should be raised to £60 as had been suggested by the Board.

In the course of discussion on purchase tax, Mrs D. Oxenham deplored the continuing attitude of many that a washing machine was a luxury. They were now necessities and should be sold free of tax.

Exhibition Space at Power Convention in June

AS in previous years there will again be a limited amount of space available for non-member firms at the British Electrical Power Convention Exhibition, 1955. This was stated last weekend by the Convention's Exhibition Committee, who accordingly invite applications from firms who are not identified with participating organisations. These applications should reach Mr V. W. Dale at 2 Savoy Hill, W.C.2, by 15 Jan. The B.E.P.C. opens at Brighton on 27 June.

OFFICIAL PUBLICATIONS

PUBLIC BOARDS. List of members, salaries, etc. Command paper 9344. HMSO. 9d.

SAFETY IN MINES RESEARCH. 32nd Annual Report (see page 18). HMSO. 3s.

MINES. Reports for 1953 of H.M. Inspectors of Mines for Northern (1s. 6d.) West Midland and Southern (1s. 6d.) and N. Eastern (2s.) Divisions. All available from HMSO.

FACTORIES. Annual report for 1953 of Chief Inspector of Factories. (see page 8). HMSO. 6s. 6d.

NATIONAL PARKS COMMISSION. Fifth report for year 1953-54 (see page 35). HMSO. 3s. 6d.

WROUGHT NON-FERROUS METALS INDUSTRY. Review of Productivity by British Productivity Council. (see page 7). 1s. 6d.

HYDRO - ELECTRIC DEVELOPMENT (Scotland) ACT. Constructional scheme No. 26 concerning Mucomir project. Confirmation order, S.I.1707, price 2d.; and explanatory memo, price 3d. (see page 39). HMSO.

Invitation to Users of Engineering Equipment

AN invitation has now been extended by the Engineering Equipment Users Association to companies who might wish to join the organisation as associate members. Formed in 1949, the object of the Association is to provide facilities for the exchange of information on the standardisation of engineering materials and equipment. Since that time progress has been made in the mechanical, electrical and civil fields of engineering, but the offer of associate membership has been made so that others may obtain the benefits technically without the same obligations as the existing eight full members. Candidates should be predominantly users and not manufacturers of engineering equipment. The Association's headquarters is at 20 Grosvenor Gardens, London, S.W.1.

CONVENIENT CRASH

Following their very successful journey-into-space stand at last year's Schoolboys' Exhibition, the E.D.A. used the same theme this year except that the journey was in the opposite direction. A flying saucer conveniently crashed near at hand and the Association duly "salvaged" it as well as its attractive crew of Neutroids.

Dates of Pakistan Trade Fair Changed

THE third Pakistan International Industries Fair at Karachi is to take place between 2 Sept. and 2 Oct., and not in the spring as was previously supposed. The possibility of the exhibition being held in the autumn instead of on the dates originally announced was foreshadowed in our issue of 23 Dec.

This postponement of the opening date will be a distinct advantage to those interested in the Fair in this country. There will now be every opportunity to organise a British Pavilion which appeared unlikely with a March opening. The Pavilion is in the hands of Auger and Turner Ltd. of 40 Gerrard St, W.1, who would like potential U.K. exhibitors to contact them as soon as possible. A closing date for applications to participate is expected to be fixed next week. Another advantage of the postponement will be that exhibitors will be able to go on to the Indian Trade Fair which opens in New Delhi on 29 Oct.

Special import quotas will be allowed by the Pakistan Government, but this is the subject of current negotiation. The quota for all U.K. exhibits is fixed at £20,000, and a substantial increase is being sought. The current figure might of course be adequate for individual exhibitors but it is scarcely suitable for any number of firms.

LECTURES ON MERCURY ARC RECTIFIERS

"MERCURY Arc Rectifiers and their Applications" is the title of a course of seven lectures being arranged by the dept. of electrical engineering at West Ham College of Technology. It will be given on Tuesday evenings between 25 Jan. and 8 March and is intended primarily for holders of a Higher National Certificate or an Engineering Degree. The course may also have appeal for others who have suitable industrial experience. Fee for the course is £2. 2s. and further details may be had from the head of the department, Mr C. T. Baldwin. Lecturers will be Mr J. Holliday of the G.E.C., Mr F. E. Spooner and Mr W. Taylor of Nevelin Electric Co., Mr R. H. Turtill of London Transport, and Dr H. Von Bertele.

Merger of Washing Machine Manufacturers

A PROPOSED merger of manufacturers of domestic washboilers and washing machines is announced. The two principal firms involved are Burco Ltd. and W. H. Dean and Son, Ltd. The latter concern is also purchasing the issued share capitals of three firms, Amplec Ltd., Henry Slack and Sons, and G. L. Howarth and Co., Ltd., all concerned in washing machine and wash boiler manufacture. Further details of the arrangements are given on page 40.

Induction Heating Business switched to Another Firm

A JOINT announcement by Wickman Ltd. and Wild-Barfield Electric Furnaces Ltd. last week states that agreement has now been reached whereby the former's induction heating business has been acquired by Wild-Barfield. The agreement took effect on 1 Jan.

The manufacture of induction heating generators and fixtures will continue as before at Cricklewood, and continuity of service is also assured for Wickman A.H.F. induction heating units already in use. Later, production will be transferred to the Barfield Works at Watford, when rearrangement of production facilities provide space to house the new business. Mr F. L. Gladwin, who has been associated with the Wickman induction heating business since its inception, has been appointed sales manager of the induction heating dept. by Wild-Barfield Electric Furnaces Ltd.

Silicone Manufacturing Plant transferred

OWNERSHIP of Albright and Wilson Ltd.'s silicone manufacturing plant at Barry in S. Wales has been transferred to Midland Silicones Ltd. This was announced by the former company last week following the completion of negotiations. Albright and Wilson are majority shareholders in Midland Silicones Ltd., who already distribute these products. The balance of shares are held by Dow Corning Corporation of America, who have been closely associated with Albright and Wilson in the manufacture of silicones in this country, and Midland Silicones Ltd. will continue to benefit from the Americans' experience and research in this field.

S.W. Board Introduce New Competition

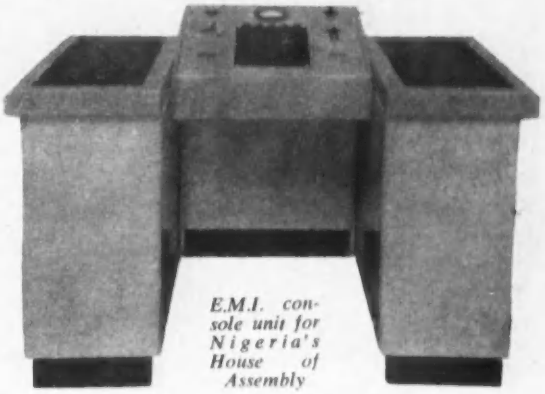
A NEW annual competition for the *Western Daily Press* challenge cup is to be introduced by the S. Western Electricity Board. The cup was originally awarded to the Board for the best decorated business premises during the coronation celebrations in 1952. It has been decided that the cup will be awarded each year to the individual or group of individuals who perform the most outstanding achievement of the year either inside or outside the scope of their employment. Some examples have been given of feats which would merit consideration including acts of gallantry, notable engineering feats, record sales, winning of area or national competitions, or an outstanding performance by a sports and social club. Decision to make the cup an annual event was made after joint consultation between advisory committees representing the Board's staff and manual workers. The panel of judges will comprise Mr E. C. Willis (Bristol sub-area manager), Mr H. Crossley (asst. solicitor at H.Q.), Mr R. Stockham (meter reader), and Mr V. W. Dite (mains foreman). The competition will start immediately and any events taking place at present will be considered by the judges.

Nigeria's "Hansard" will be a Tape Recorder

SHORTLY to be installed in the House of Assembly of the Western Region of Nigeria is probably the most up-to-date method of recording debates and proceedings. Even the most skilful shorthand writers which Westminster has known would probably find the problems of language and dialect almost insurmountable and consequently the Crown Agents decided on a tape recording system. This is being made by E.M.I. Ltd. of Hayes, Middlesex.

A single console will house all the microphone controls, amplifiers and power supply units. On the control desk seven microphone switches will be located on an outline floor plan corresponding to the fixed microphone positions on the floor of the House. There will also be five spare inputs. The operator will be in a sound-proof room and as speakers rise he will only have to switch in the appropriate microphone. The technical operations of mixing and controlling volume levels will be performed automatically.

From the console, the speech will be fed to four type TR50 tape recorders, each of which giving an hour of recording per reel. At the same time microphone outputs will be fed through separate amplifiers to a dozen headphone sets in the Press Gallery.



E.M.I. console unit for Nigeria's House of Assembly

Farm Electrification Course for Manweb Staff

MOST Boards have discovered in recent months that they have a shortage of suitably trained staff to cope with the rapid increase in the rate of rural electrification. So many farmers are receiving a supply of electricity for the first time that there are insufficient employees on the Board's staff to help and advise agricultural consumers to obtain the most efficient and economic use of the power available. A number of Boards have arranged courses of instruction for their staff to cope with this situation and the latest to do so is the Merseyside and N. Wales Board whose Farm Electrification Course opens next Monday. It will take place at the Caernarvonshire County Farm Institute at Glynllifon and will be attended by 20 members of the commercial staff working in agricultural districts.

The course extends over five days. There will be two lectures each day as well as discussions, study groups and appropriate films. It may be summarised in a general way by the fact that a day is devoted to cattle feeding, another to crops and a third to dairy farming. Both theoretical and practical training will be given.

The First Half-Century

It is rather alarming to read that the London Road Car Co. proposes immediately to begin substituting mechanical for horse traction, and though the change will be made gradually it is evidently intended to be carried through. Buses are always the noisiest part of the traffic, and judging by the few motor buses now running each of these will make three times the noise of an ordinary bus. Nor is that the worst; the casual and occasional motor car leaves behind it a trail of stench for about a hundred yards. We put up with that as only an occasional nuisance, but what will it be when the buses keep it up from the Welsh Harp to the Bank, or from Hammersmith to Whitechapel? If only electric buses could be used that objection, and to some extent that of noise also, would disappear, but the accumulator bus has never yet managed to make itself a commercial success.—*From our issue of 5th January* 1905.

Schoolchildren attend Atomic Lecture

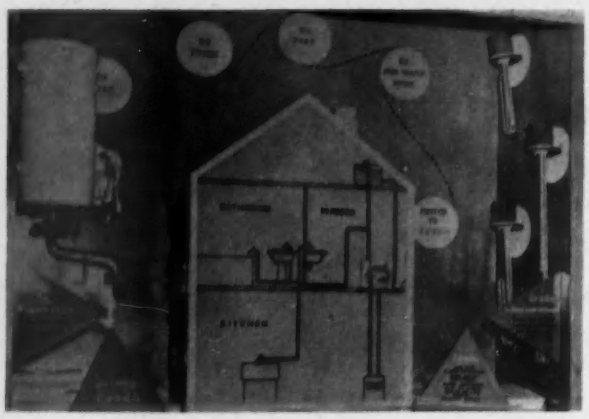
THE I.E.E. annual Christmas lecture for older schoolchildren was given last week by Dr Thomas Alibone. His subject (as previously reported) was "Nuclear Power —Electricity from Uranium." With the aid of models and films, the whole development of atomic physics was explained to the enthralled youngsters. To the question posed by one smart lad who enquired what would be used when supplies of Uranium 235 were exhausted Dr Alibone countered with details of the latest experiments with breeder reactors, and use of hydrogen. However, he was surprised when another questioned the efficiency of the heat exchanger suggesting that should not liquid mercury be used. In reply he pointed out that exciting experiments were on hand using liquid metals such as sodium and potassium but mercury would be unsatisfactory.

U.K. Firm to Manufacture in Germany

IN ORDER to overcome restrictions and import duties which were proving an obstacle to expansion in the German market, the Orpington firm of Cimex-Fraser Tuson Ltd. have decided to set up their own factory and a new company in Hamburg. The new company will be known as Cimex-Reinigungs Maschinen G.m.b.H., and will be entirely British owned. Mr F. J. Elvy, managing director, left London for Hamburg last Monday. He stated that record sales had been achieved in every country in which they traded except Germany, and the only way to compete with the Germans was to produce better quality goods at the same or lower prices, possibly in Germany itself. The company are well known for their deck-scrubbing and polishing machines, and also for their turf-dryer used with success during last summer's Test matches with Pakistan.

Factory at Shepperton

CELEBRATIONS began a little before Christmas for the staff of Winston Electronics Ltd. Just before the holiday, Mr John D. Profumo, M.P., laid the first brick of the company's new factory to be built at Shepperton, Middlesex. This business only came into being about five years ago when the founder, Mr F. W. Reynolds, started work on his own. He was previously area sales manager with Standard Telephones and Cables in Sheffield. He opened his first factory at Hampton Hill, and the new works are expected to employ about 80 people.



Yet another display unit has been produced by Simplex Electric Co., Ltd., featuring Creda water - heating equipment. The latest, illustrated here, will be shown at various exhibitions up and down the country. Another was reproduced in our 25 Nov. issue

Two or Three Storeys wanted for Showroom Site

SHOWROOMS proposed by the S.W. Scotland Electricity Board at the junction of the High St and Smith St, Greenock, are raising some problems. Preliminary plans submitted to the Corporation have been rejected on the grounds that the suggested single-storey building would be out of keeping with neighbouring premises, and two or three storeys were required. The Board have showrooms and a substation in Hunter Place which are due for demolition and although the substation's function is being replaced from other sources, the Board is anxious to retain the showrooms in the central area. The Corporation is asking the Board to develop the site by building two or three storeys, and that offices or other accommodation be provided above the street level shop. Failing this, the Corporation will be willing to discuss the possibility of an arrangement whereby the upper floors could be built as flats or maisonnettes, under arrangement with the Corporation.

Vacuum Cleaners in Mines

IN view of the numerous reports last week on the subject of vacuum cleaner tests in coal mines to prevent pit explosions, we are reminded that it is over two years ago now that the British Vacuum Cleaner and Engineering Co., Ltd., were asked by the Ministry of Fuel and Power to produce an experimental unit. B.V.C. technicians have spent a good deal of time on research into the removal of dangerous dust by vacuum cleaning, and the result was the production of a prototype unit (model T.91). In fact it was in 1907 that experiments were first carried out with a cleaner unit produced by the company's founder, Mr H. Cecil Booth.

A Manchester A.G.M.

WE are informed that the annual meeting of the Manchester branch of E.I.B.A. will take place at 5.45 p.m. on 31 Jan. Venue will be the Engineers' Club in Albert Sq.

Private Displays of Motor Control Gear

SINCE the Electrical Exhibition at Earls Court last March, Arrow Electric Switches Ltd. have taken their display of motor control gear to a number of provincial centres for private exhibitions. During the second half of the year they visited Birmingham, Glasgow, Bradford and finally the Midland Hotel in Manchester. All the two-day shows were proved most successful and were attended by some 75 design engineers and purchasing officers on each occasion. Plans for 1955 have still to be worked out but it is probable that similar shows will be held following the A.S.E.E. exhibition in March.

Historical Collection of Thermionic Valves

THE McVitie Weston collection of valves is being displayed in the entrance hall of the Radio Building at the New Southgate works of Standard Telephones and Cables Ltd. It forms a significant exhibition following the recent celebration of the jubilee of Sir Ambrose Fleming's first thermionic valve. In arranging the McVitie Weston collection the company has made a careful selection in an attempt to trace the historical development of the thermionic tube. A complete catalogue of the collection is being prepared.

Mr R. McVitie Weston, a solicitor, started his collection in 1920 when he began building his own radio valve receivers. His interest spread from types then current to those of every age and type, and by 1934 his collection numbered several hundred. By diverse means many more were added and four years later exhibits numbered about 2,000.

ADVICE ON SPECTACLES

EARLY in the New Year, the Information Council of the Optical Industry are to distribute to electrical engineers a small pocket folder containing some brief advice and a reminder about the care and needs of the eyes. The folder points out the importance of the eyes and suggests how they can be catered for and protected. The organisation operates from 72 Fleet St, London E.C.4.

NEWS IN BRIEF

Portable electric generators have been added to the list of commodities covered by the Token Import Scheme. The scheme is to continue through 1955 for imports of goods from Canada and the U.S. but quotas will remain at last year's level of 30% of exports to U.K. between 1936-38. Total value of goods imported under the scheme is about £3 millions a year.

Eastern Region of British Railways have awarded a contract to Siemens and General Electric Railway Signal Co., Ltd., in respect of alterations to signalling necessitated by the electrification of the Shenfield and Chelmsford line.

Bulletin of special courses in higher technology for the spring and summer terms has been issued by the London and Home Counties Regional Advisory Council for Higher Technological Education.

There was a notable exchange of products at the Savoy Hotel, London, recently. The five millionth Varley Coil, made by Oliver Pell Control Ltd., was handed over for assembly in an S.U. petrol pump, and the 4,999,999th pump made by S.U. Carburetter Co., Ltd., was handed over in return. As from the New Year, Oliver Pell will be distributing products of Hurseal Ltd., and Nelson Engineering Co., Ltd., it was announced.

Sundry publicity material has been produced for 18 June by the Fathers' Day Association Ltd., of 16 Mumford Court, Lawrence Lane, London, E.C.2.

Over 200 members and their friends attended the annual stag party dinner and smoker last month of the Electrical Trades' Commercial Travellers' Assoc.

First of this year's courses organised by the Institute of Personnel Management will be on Wage Administration, Negotiation and Industrial Relations. It will take place at the University of Birmingham between 16 and 21 Jan.

At a ceremony at Cefn Mawr, 146 employees of Monsanto Chemicals Ltd. who had served for 25 years or more received appropriate rewards.

Ministry of Education has approved in principle a proposal to establish part-time day and evening Higher National Certificate courses in electrical engineering at The College, Swindon.

Hartley Electromotives Ltd. and Hartley Baird Ltd. held their first annual staff dance since their amalgamation last March. Nearly 800 staff, their friends and guests attended the function.

A competition in cookery, laundry and home management is being organised by the Gas Council to find Mr Therm's Bride of the Year. It is open to all women

who marry between 1 Jan. 1954 and 30 April next. Prizes amounting to over £1,000 will be awarded to the winners after the final at the Royal Festival Hall, London, on 1 Nov. 1955 when 12 finalists will compete.

Social club of S. Wales Switchgear Ltd., visited local hospitals and neighbouring towns in the evenings just before Christmas with a seasonal tableau and choir.

Another highly successful year was reported at the annual Apprentice prize giving which took place at Hoover Ltd.'s Perivale factory just before Christmas.

Twenty-first birthday celebrations have taken place at E.A.W. branches at Ormskirk and Inverness.

Annual meeting of the Northern Counties area of E.I.B.A. will take place at Carliol House, Newcastle-on-Tyne, at 3 p.m. on 13 Jan. Chairman will be Mr J. C. Mitchell.

The range of totally enclosed flameproof motors made by Newman Industries Ltd., of Bristol, are now C.S.A. approved, the company announced last week.

A course of four lectures on Sound is being arranged by the education committee of the British Kinematograph Society. It will be held at Ealing Studios on Monday evening beginning on 17 Jan.

Guest speaker at the Rotary Club of London's luncheon next Wednesday (12 Jan.) will be Prof O. A. Saunders. He will speak on the Impact of Modern Scientific and Industrial Development on Industry.

Walthamstow's dog track is now equipped with electric heating to keep the grass free of frost and ice.

New itinerary for Pye Ltd.'s "People are Funny" show includes visits to Lowestoft, Luton, Sheffield, Plymouth, Aldershot, Norwich, Aberdeen, York, Grimsby and Oxford. It has proved highly successful and popular during its first year, among the public and dealers alike.

Sayings OF THE WEEK

"As a result of electronic instrumentation and control techniques the steel industry is able to produce a formidable tonnage output with an accuracy formerly associated only with the most delicate manufacturing processes." . . . From the report of H.M. Inspector of Factories.

"I suggest that overhead wires should be painted white. Pigeons might then distinguish them; something they can't do now because the colour of the wires blends with the surrounding ground." . . . MR E. T. BROADWAY, at the meeting of Bathavon R.D.C.

"The story of Britain's present prosperity is written in the order books of her commercial travellers." . . . LT-COL MAURICE W. B. BATCHELOR, president of the United Commercial Travellers' Association, in a New Year's message.

ELECTRIC SUPPLY NEWS

Bathavon

The R.D.C. is opposing a proposal of the South Western Electricity Board to erect overhead cables at Bathford at the entrance to the Limpley Stoke Valley. The council want the lines placed underground to avoid spoiling amenities. The Ministry of Fuel and Power is holding a public inquiry into the matter today, 6 Jan., at the Council's offices.

Belfast

The Corporation Electricity Committee is awaiting a report from the chairman, Councillor Geddis, and four other members regarding the incorporation of a district heating system with the generation of electricity at the corporation's power stations. Meanwhile, the city electrical engineer, Mr R. P. Watson, has already submitted a report in which he suggests that an overall saving may be effected in the use of coal. The combined efficiency of such a joint heat-electric service, however, depends upon a number of factors, including the proximity of prospective heat consumers to the source of supply and the incident and magnitude of demands for heat and electricity. Should a balance in requirement between the two related services be unobtainable, it usually becomes necessary to incorporate thermal storage, which adds appreciably to the initial capital cost, and could put the project "out of court" on economic grounds, he points out. Furthermore, to provide district heating from an existing conventional steam generating station necessitates major modifications in respect of the prime movers and their auxiliary plant. In the case of power station East, apart from the cost involved in making such modifications, it would be most undesirable at this juncture to lay off plant for any length of time. If and when replacement of the older plant at power station East is undertaken it might be possible to introduce district heating. The possibility of adopting district heating was not specifically considered when arrangements for the power station West were made, and to make alterations now would delay commissioning of the plant.

North of Scotland

The Mucomir hydro-electric project, prepared by the North of Scotland Hydro-Electric Board, has been confirmed by the Rt Hon James Stuart, Secretary of State for Scotland. Intended to augment supplies of electricity in Fort William and the surrounding district, the scheme will make use of the flow of water through the Mucomir Cut, the artificial channel constructed when the Caledonian Canal was built to take all the outflow from Loch Lochy apart from what is required for the canal itself. Water will be led from the Mucomir Cut by a short tunnel to a 1,500 kW generating station on the north bank of the River Lochy. A fish pass will be provided to allow the salmon to reach Loch Lochy. The scheme is estimated to cost £375,000 and will produce 9 million units annually.

North Wales

Merioneth County Council has decided to oppose the North Wales Hydro-Electric Bill for the proposed Blaenau Ffestiniog pumped-storage scheme. A committee was appointed to join representatives of Snowdonia National Park Advisory Committee and Blaenau Ffestiniog Urban Council, and Sir Patrick Abercrombie to meet officials of the B.E.A. to discuss the proposals and visit the sites. (This meeting is to take place on 7 Jan.) The clerk to the County Council, Mr D. W. Jones-Williams, pointed out that opposition at this stage did not mean they were wholly against the scheme. He said the Blaenau Ffestiniog U.D.C. felt that the scheme would be of great benefit to the area and should be supported.

Somerset

Thirteen families in the village of Dunball, near Bridgwater, were provided with their own generating plant by the South Western Electricity Board over Christmas. This method was resorted to because normal supplies had to be disconnected while engineers connected up new 11 kV feeders to reinforce power supplies to important industries in the area. A 37 h.p. diesel alternator was transported from Bristol to give the necessary supplies to the village.

LIGHTING SCHEMES

Carshalton. Gas street lighting is to be converted to electricity at a cost of £116,000.

Coleraine. The borough council have approved a draft scheme, prepared by the Electricity Board for Northern Ireland, for lighting the streets of the borough with fluorescent lamps, involving 545 lamps at a total cost of £31,060.

Ellesmere Port. The Council is to convert 300 gas street lamps to electricity in the coming year.

Scarborough. The Water and Streets Committee plans to spend £24,000 next year in its scheme for changing over the street lighting from gas to electricity.

Southport. The T.C. proposes to spend £14,245 on improved street lighting in Eastbourne Rd, Cemetery Rd, Ash St, St Luke's Rd, Hartwood Rd, Manchester Rd, Roe Lne, Mill Lne, Botanic Rd, Guildford Rd, Kew Rd, and Carr Lne.

Tipton. The council has asked the borough surveyor to prepare a scheme for lighting part of the Birmingham—Wolverhampton road with 250 W mercury discharge lamps, although Dudley and the M.o.T. are opposed to such proposals.

COMPANY ACTIVITIES

THE full report of the Plessey Co., which manufactures an extensive range of components used by electronic, electrical and mechanical engineers, discloses the wisdom of savouring free bonus issues with new issues of shares for cash. As well as a 100% scrip issue the company made a 60% rights issue as part of its capital reconstruction. The latest balance sheet shows that whilst stocks are practically unchanged at £2·48 millions, liquid resources are up from £580,000 to £994,000. From the extended production facilities there was an increased turnover and that led to a 30% increase to £1 million in consolidated trading profits. Equity earnings of 108% allowing for another six months E.P.L., provide a 5% cover for the 20% dividend, paid on the increased capital. Further expansion is planned with capital commitments of £370,000. Chairman, Mr A. G. Clark says the usual things about rising production costs, but I think when he says that it is possible to price oneself out of world markets, that he may be overstating the case. As well as installing new methods and machinery it should be possible by reason of more rapid turnover and output to offset higher costs, especially if a company is prepared to reduce margins.

Although the chairman of Morgan Crucible had already announced that the interim dividend would be increased, the announcement of a 6% payment compared with 3¼% came as a surprise. It follows a rise in the previous final payment from 8¼% to 10¼%. According to the chairman, the avowed object is to provide "a more even division between interim and final dividend," and that "an increase in total distribution is not implied." Dividend has already gone up from 12½% to 14% and as the last earnings were almost 40%, the board has not, so far, given up its conservative outlook.

But the price of the shares at 68s. suggests that the market has some hopes at least that there may be a further increase in the final payment next July. If another 1% were added, making 15%, the yield would be about 4¼%. But indications are that the company is doing still better in the current year, partly due to a general improvement in business and partly to improved manufacturing efficiency. Whether the dividend goes higher than the 15% or not, the shares are a first class purchase.—*From our City Correspondent.*

Allen West and Co. Ltd.

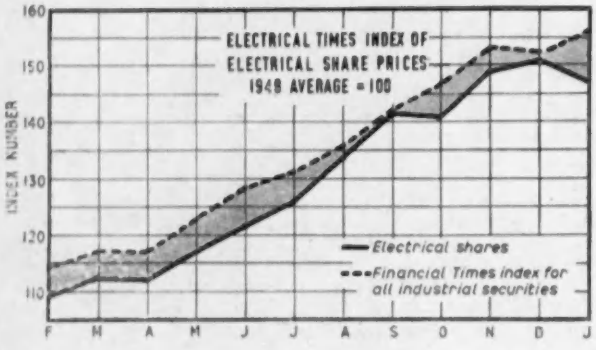
The directors have applied to the Capital Issues Committee for consent to increase the authorised capital from £1,250,000 to £2,000,000 and for permission to make a scrip issue, by capitalisation of reserves, on the basis of one new Ordinary 5s. share for every two 5s. stock units held.

Bruce Peebles and Co. Ltd.

The expectation that the dividend would be maintained at 15% on the doubled Ordinary capital, was expressed by Sir William Darling, the chairman, at the extraordinary general meeting last week. Furthermore, it was hoped that the Board would be in a position to recommend a cash bonus which might, however, not be so large a percentage as that paid for 1953, he added. (The special bonus last year was 10%).

Burco Ltd.

The boards of Burco Ltd., and of W. H. Dean and Son Ltd. (another washboiler manufacturer) have agreed in principle to a merger of the two companies by the formation of a holding company and an exchange of shares. Peat, Marwick, Mitchell and Co. has been asked to investigate the accounts of both companies and their subsidiaries, with a view to advising the respective Boards upon the appropriate basis for such an exchange. The directors hope to be able to give shareholders further details of the basis of exchange by the end of this month.



Electrical share prices declined slightly during December and the 'Electrical Times' index showed a fall 3.2 to 147.4. In the same period, however, the 'Financial Times' index for all industrial shares continued to rise, this time by 4.1 to 156.7

W. H. Dean and Son

The proposed merger of this concern, which is primarily concerned in the manufacture of gas washboilers, with Burco Ltd., is noted in the previous column. The Board of W. H. Dean and Son Ltd., has also announced that it has entered into agreements to purchase for cash, the whole of the issued share capitals of three private companies, Henry Slack and Sons, G. L. Howarth and Co., and Amplec Ltd. The two former firms manufacture gas washboilers and washing machines, while Amplec Ltd. have for many years made such electrical operated appliances.

Electric Furnace Co.

An extraordinary meeting is to be held on 18 Jan., to sanction the capitalisation issues of fully paid Ordinary shares in the ratio of one-for-one and fully paid 5½% Cumulative Preference shares (to the holders of the 7% Cum. Pref. in return for their surrendering their rights to 1½% dividend p.a.).

H. Fisher (Oldham) Ltd.

The accounts for the year to June last show a loss of over £7,000, without provision for accrued interest and receivership costs. The informal Committee and the joint receivers state that it appears evident that this loss was virtually all incurred during the first six months of the period, and it would now seem that the business is running at a profit. A working arrangement for the production of washing machines for a supplier of international repute is now in operation and it is considered that this will secure a reasonable return to the company, and with the prospect of continuity. There are, however, still no proposals for the settlement of the creditors' claims or for the introduction of sufficient capital to enable a reconstruction scheme to be formulated. The Committee and the receivers are of the opinion that forcible realisation of the assets at this juncture would not be in the interests of the ordinary creditors, and the Committee recommends a continuation of the moratorium.

Radio and Television Trust Ltd.

At last Thursday's meeting, approval was given to acceptance of the offer of £425,440 made by the General Cable Manufacturing Co., for the holding in Britannic Electric Cable and Construction Co., to which we referred on 16 Dec. The Trust's holding in Britannic Electric Cable and Construction Co., comprised 531,800 out of the issued capital of 540,000 5s. shares. F. McNeill and Co., Ltd., which controls General Cable Manufacturing Co., Ltd., has joined in the purchase.

Dividends Declared

W. H. Allen Sons and Co. Interim of 5% (*same*).

Bennis Combustion Ltd. Interim 5% (*same*).

Morgan Crucible Co., Ltd. Interim of 6% (3¼%).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

7 Jan.—Dublin T.C. 5,000 yd of PBJ cable.—See 30 Dec. issue.

7 Jan.—Sheffield T.C. Installations at colleges of technology and commerce in Pond St.—See 25 Nov. issue.

8 Jan.—Bootle T.C. Electrical goods, cables and lamps during year from 1 Apr. —See 23 Dec. issue.

8 Jan.—Dagenham T.C. Lamps, cables conduit and accessories in year from 1 Apr.—See 9 Dec. issue.

8 Jan.—Ruislip - Northwood U.D.C. Lamps in year from 1 Apr.—See 2 Dec. issue.

10 Jan.—N. Ireland. Installation in 202 dwellings at Dunmurry. — See 30 Dec. issue.

10 Jan.—Sale T.C. Concrete columns, lanterns, lamps, time switches, etc., for lighting along Northenden Rd and Green Lane.—See 23 Dec. issue.

10 Jan.—West Riding. Installation at Stainforth modern school.—See 30 Dec. issue.

10 Jan.—West Riding. Rewiring in Harrogate Technical School.—Advertised in 9 Dec. issue.

12 Jan.—Dublin. Three electric goods lifts for Port and Docks Board.—See 9 Dec. issue.

12 Jan.—Dublin. Three overhead travelling electric gantry cranes.—See 2 Dec. issue.

12 Jan.—Scunthorpe T.C. Concrete columns, lanterns, etc.—Advertised in 23 Dec. issue.

14 Jan.— Melrose. Electrical installations and equipment for Borders Hospitals Board of Management in year from 1 Apr. Apply by above date to Group Secretary and Treasurer, Newstead, Melrose.

15 Jan.—Bolton T.C. Supply of 66 street lighting units comprising steel poles, lanterns, sodium discharge lamps, etc, for trunk road A6. Lighting Superintendent, Marsden Rd.

15 Jan.—Selkirk T.C. Electrical installation in 34 houses in Bannerfield housing scheme. Town Clerk, Municipal Bldgs.

16 Jan.—Whiston (Lancs) P.C. Sodium vapour discharge lighting units on Liverpool-Warrington trunk road. — Advertised in 16 Dec. issue.

17 Jan.—Carlisle T.C. Supply and erection of 144 steel columns with 74 fluorescent and 71 mercury vapour lamps, control gear and time switches. City Engineer, Municipal Offices.

17 Jan.—Exeter T.C. Vertical spindle electric pump at Countess Wear sewage works.—See 9 Dec. issue.

17 Jan.—Keighley T.C. Street lighting to class A standard in centre of town.—See 30 Dec. issue.

17 Jan.—Marlborough (Wilts.) R.D.C. Vertical unchokeable sewage pumps and ancillary equipment for Aldbourne drainage scheme.—See 23 Dec. issue.

17 Jan.—Newbury T.C. Steel columns and lighting equipment for Oxford Rd.—Advertised in 23 Dec. issue.

17 Jan.—West Riding. Rewiring at Todmorden Castlehill J.M. school. County Architect, Bishopgarth, Westfield Rd, Wakefield.

17 Jan.—Worcester. Supply of lamps for fire service. Chief Fire Officer, Copenhagen St.

18 Jan. — Ilfracombe U.D.C. Concrete columns with fluorescent and sodium lanterns, etc.—Advertised in 16 Dec. issue.

18 Jan.—Penybont R.D.C. Installation in 468 houses.—See 23 Dec. issue.

18 Jan.—Plymouth T.C. Supply of electric lamps in year from 1 Apr. Stores Officer, Municipal Offices, Athenaeum Place, Lockyer St.

18 Jan.—Stockport T.C. Rewiring electrical installation at Reddish fire station. Borough Surveyor, Town Hall. Deposit £2. 2s.

19 Jan.—Fareham U.D.C. Fittings and lamps in year from 1 Apl.—See 16 Dec. issue.

19 Jan.—Nottingham T.C. Lamps and accessories in year from 1 Apr.—See 30 Dec. issue.

20 Jan.—Belfast T.C. Tenders invited for (1) refrigerator and steaming oven at Richmond Lodge school; (2) alterations to switchgear, etc., at Annadale boys' and Ashfield girls' grammar schools; and (3) overhaul of installation at Ashfield girls' intermediate school. Education Architect, 40 Academy St.

21 Jan.—Beckenham T.C. Contractors invited to tender for jobbing work in electrical trades during year from 1 Apr. Borough Engineer, Town Hall.

21 Jan.—Dundalk U.D.C. Two pumping units with accessories for water supply augmentation scheme.—See 2 Dec. issue.

21 Jan.—Luton T.C. Electrical installation at 32 Guildford St to provide school accommodation. Borough Engineer, Town Hall. Deposit £2. 2s.

21 Jan.—Wanstead and Woodford T.C. Installation of 160 W blended lighting along 29 roads, comprising some 270 units. Borough Engineer, Municipal Offices, Woodford, E.18. Deposit £2. 2s. —Advertised in this issue.

22 Jan.—Bath T.C. Supply of low voltage electric cables, discharge lamps, control gear and fittings, tungsten lamps and fittings, street lighting columns, groups A and B lanterns and time switches in year from 1 Apr. City and Waterworks Engineer, Guildhall.

22 Jan.—Manchester T.C. Transport Dept. requires supplies of switches, conduit tubing, insulation tape, cable, etc. General Manager of Dept, 55 Piccadilly.

24 Jan.—Lanarkshire. Installation in fire station at Lanark.—See 16 Dec. issue.

24 Jan.—Newcastle-on-Tyne. Electric cargo-grabbing cranes at Albert Edward Dock.—See 2 Dec. issue.

25 Jan.—Flint T.C. Installation in 17 dwellings on Castle Ward site.—Advertised in 23 Dec. issue.

25 Jan.—N. Ireland. Electrical installation at Moat primary school, Lisnaskea. Education Architect, 27 High St, Enniskillen. Deposit £2. 2s.

28 Jan.—Belfast T.C. Various supplies required by Electricity Dept, including time switches, distribution transformers, thermostats for cookers and immersion heaters, washboilers, kettles, cables, transformer kiosks, etc. Tender form, No. 31, from Dept. at East Bridge St, at 10s. a copy.—Advertised in this issue.

28 Jan.—Yeovil T.C. Supply and erection of 36 15 ft steel columns with 100 W tungsten lamps, lanterns, etc, for street lighting on Larkhill estate. A. Heal, borough surveyor, Municipal Offices, King George St.—Advertised in this issue.

29 Jan.—Bedlington (Northumb) U.D.C. Electrical goods during year from 1 Apr. —See 23 Dec. issue.

29 Jan.—Co. Louth. Electrically operated pumping units, 10,000 g.h.p. capacity for Ardee water supply.—See 23 Dec. issue.

29 Jan.—Prestwich T.C. Equipment and lamps required during year from 1 Apr. —See 23 Dec. issue.

29 Jan.—Runcorn R.D.C. Supply and installation of concrete and steel columns, bracket arms, a catenary suspension section, lanterns and mercury vapour lamps along about 2,200 yd of trunk road A56 at Frodsham and 2,300 yd of same road at Helsby. Engineer and Surveyor, Castle Park, Frodsham, via Warrington. Deposit £2. 2s.—Advertised in this issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 115 queries answered this week

Flexible rubber test leads, to carry up to 20 amps, incorporating moulded in bulldog clips or spade terminals, makers of? E.E.B.—Reliance Electrical Wire Co., Ltd., Fingal Works, Staffa Rd, E.10; British Insulated Callenders Cables Ltd., 21 Bloomsbury St, W.C.1.

"Paladin" food mixers, suppliers of? B.C.—Barclay and Sons Ltd., 28 Old Brompton Rd, S.W.7.

Cable spiking gun cartridge operated, makers of? E.E.B.—Accles and Shelvoke Ltd., Talford St Works, Aston, Birmingham 6.

"Hancock" electric soldering bolt, makers of? B.W.—We presume this refers to the Hanstock unit which is now being carried on by the Cyc Arc Stud Welding Division, of Crompton Parkinson Ltd., 1/3 Brixton Rd, S.W.9.

"Valmix" mixers, makers of? A.B.—Valmade Ltd., New Chapel Rd, High St, Feltham, Middx.

"Butcher" earthing system, makers of? T.E. — Electro-Methods Ltd., Caxton Way, Stevenage, Herts.

"Tudor" car heaters, makers of? D.E.—Tudor Accessories Ltd., Beaconsfield Rd, Hayes, Middx.

31 Jan.—Aireborough U.D.C. Heating branch library at Guiseley.—See 30 Dec. issue.

31 Jan.—Antrim R.D.C. Sewage pumps, with control gear, heating and lighting.—See 16 Dec. issue.

31 Jan.—Huddersfield T.C. Supply of tungsten filament, mercury vapour and sodium lamps and cables in year from 1 Apr. Borough Engineer and Surveyor, High St Bldgs.

2 Feb.—Wiltshire. Installation at St. Thomas' secondary modern school, Salisbury.—See 30 Dec. issue.

3 Feb.—Belfast T.C. Two electric level luffing, slewing and travelling coal unloading cranes for Power Station West.—Advertised in 30 Dec. issue.

4 Feb.—Stoke-on-Trent T.C. Electrical installation in Meir infants and Grove secondary modern schools. Apply by 12 Jan. to City Architect, Kingsway Chambers, Kingsway. Deposit £2 each.

5 Feb.—Swansea T.C. Lamps, steel concrete pillars and lighting equipment in year from 1 Apr.—Advertised in 30 Dec. issue.

14 Feb.—Huntingdon T.C. Installation of electrical plant in construction of two pumping stations. J. D. and D. M. Watson, consulting engineers, 18 Queen Anne's Gate, Westminster. Deposit £10. 10s.

15 Feb.—Belper U.D.C. Six sewage pumping sets.—See 30 Dec. issue.

No date stated.—Ayrshire. Supply of steel standards, electrical equipment, lanterns for 140 W sodium vapour electric discharge lamps, and installation work, in New Cunnock street lighting scheme along A.76, under four schedules. County Engineer, County Buildings, Ayr.

No date stated.—Hertfordshire. Applications invited for inclusion on approved list of contractors.—See 30 Dec. issue.

No date stated—Oxfordshire. Lighting, power and alarm bell installation for proposed fire station and ambulance depot at Banbury. Names to County Architect, Park End St Offices, Oxford.

No date stated.—N. of Scotland H.E. Board. Supply of outdoor 132 kV switchgear and 11 kV indoor switchgear for St Fillans power station. Kennedy and Donkin, 12 Caxton St, London, S.W.1. Deposit £2. 2s.—Advertised in this issue.

No date stated—N. of Scotland H.E. Board. Provision of outdoor 33 kV switchgear and ancillary equipment for Dalchonzie substation. Kennedy and Donkin, 12 Caxton St, London, S.W.1. Deposit £2. 2s.—Advertised in this issue.

No date stated—Chester T.C. Electric lamps included in annual contracts to be let. Applications to G. Burkinshaw, town clerk, Town Hall.

. . . and Overseas

Details of items marked • may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.

31 Jan.—India. Supply of distribution transformers of various capacities, 11 kV/420 V and 6·6 kV/420 V. Documents from Stores Officer, Delhi State Electricity Board, Rajghat, New Delhi, at Rs.10 per copy.

1 Feb.—U.S.A. Supply of six 67368 kVA a.c. generators and appurtenances for Chief Joseph Dam power house. U.S. Army Corps of Engrs, Seattle District, 4735 E. Marginal Way, Seattle 4. B.o.T. (Ref.: ESB 29904/54).•

7 Feb.—Iraq. Supply and erection of 200 kW d.c. generating set at Hindivah for Directorate General of Municipalities, Baghdad. Deposit ID.500. B.o.T. (Ref.: ESB 29376/54).•

9 Feb.—Iraq. Supply and erection of a 200 kW d.c. generating set at Samawa. Directorate General of Municipalities, Baghdad. Deposit ID.500. B.o.T. (Ref.: ESB 29377/54).•

10 Feb.—New Zealand. Supply of portable parabolic reflector type electric radiators, 230 V a.c. Director, Stores Div., G.P.O., Windsor Building, 49 Willis St, Wellington. B.o.T. (Ref.: ESB 29406/54).•

12 Feb.—Iraq. Tenders invited for supply and erection of (*a*) 50 kW and 100 kW d.c. generating sets at Mahmoudiya; and (*b*) 100 kW and 150 kW d.c. sets at Telafar. These are separate contracts and deposit in each case is ID.500. Directorate General of Municipalities, Baghdad. B.o.T. (Refs.: ESB 29378/54 and 29379/54 resp.).•

14 Feb.—Iraq. Supply and erection of 150 kW d.c. generating set at Samarra, and two 50 kW d.c. sets for Sinjar, Mosul Liwa. These are separate contracts. Documents at ID.500 in each case. Directorate General of Municipalities, Baghdad. B.o.T. (Refs.: ESB 29319/54 and ESB 29318/54 resp.).•

15 Feb.—Iraq. Tenders invited for supply and erection of 100 kW d.c. generating sets at Tikrit for Directorate General of Municipalities, Baghdad. Documents at ID.500. B.o.T. (Ref.: ESB 29371/54).•

15 Feb.—New Zealand. Supply of 2,600 fuse mountings, 25-pair without fuses for Post and Telegraph Department, Wellington. Ref.: P and T 150/7489. B.o.T. (Ref.: ESB 29548/54).•

22 Feb.—New Zealand. Post and Telegraph Dept., Wellington, require electrical instruments and accessories including ammeters, detectors, rectifiers, voltmeters, etc. Quote ref. P. and T. 150/7581. B.o.T. (Ref: ESB 29549/54).•

24 Feb.—Tangier. Installation of street lighting in various streets for Water and Electricity Board. L'Ingenieur Directeur de la Regie, Rue Foucauld 89, 1er etage, Tangier. B.o.T. (Ref.: ESB 29289/54).•

25 Feb.—Australia. Brisbane city council requires supply of 33,000 V gauged air break switches. Documents from council's Department of Electricity, Kelvin Hse, Adelaide St, Brisbane, at 10s. 6d. a set. Tender No. E.47/54. B.o.T. (Ref.: ESB 29509/54).•

26 Feb.—India. Manufacture, supply and erection of thermal power station comprising two 3,000 kW turbo alternator sets with boilers and auxiliaries. Documents from G. C. Mukerji, executive engineer, Rihand Project Div., Electricity Dept., Allahabad, at Rs.25.

18 Mar.—Kuwait. Supply and erection of 33 kV indoor type metalclad switchgear, control room equipment and alternator pit equipment for four 10,000 kW alternators for power station "B". President of Dept. of Electricity, Govt. of Kuwait.—Advertised in this issue.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 4 January

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	289	+9	231
„ (3 months)	277½	+9	219½
LEAD, refined pig, min. 99·97% purity (cash)	106½	+1½	89½
„ (3 months)	105	+1	88½
TIN, refined, min. 99·75% purity (settlement)	694	—	662½
„ (3 months)	696	+1	637½
ALUMINIUM, ingots 99-99·5%	163	+7	156
ZINC, virgin, min. 98% purity (cash)	84½	+1	75½
„ (3 months)	83½	+1½	74
RUBBER No. 1, RSS, spot (per lb.)	31 5/16d.	+4 1/16d.	17 1/16d.
„ c.i.f. basis, ports, Feb. (per lb.)	28 1/16d.	+2d.	17d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	51
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

B.E.A. Three cooling towers at Goldington, Film Cooling Towers (1925), Ltd., and 11 kV and lower voltage cables and accessories at same, Malcolm and Allen, Ltd.; One 30 MVA interbus transformer and rewinding of two existing 30 MVA transformers at Nottingham, Hackbridge and Hewittic Electric Co., Ltd.; One 106 MVA 275 kV generator transformer at Willington "A", English Electric Co., Ltd.: High pressure pipework and valves at Dalmarnock, Stewarts and Lloyds, Ltd.; Ferrybridge "B" power station, Yorks: Structural steelwork, United Steel Structural Co., Ltd.; Barony power station, Ayr: Superstructures for main and other buildings, John Laing and Son, Ltd.

Hereford T.C. Lighting, servicing, etc., of main road street lamps, Midlands Electricity Board, £2,134 p.a.

Newcastle. Supply of cable and lamps for Tyne Improvement Commission for a year, Hackbridge Cable Co., Ltd.; Hardy and Hogg, and Samuel Gatrix Ltd.

Richmond (Sur.) T.C. Electric hoisting gear at Terrace Garden Well, Hoisting Appliance Co., £1,080.

Southgate T.C. Supply and erection of equipment for Third Year's Street Lighting programme, Cohen Bros. (Electrical) Ltd., £7,327.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Triangles and f in design. 735,044. Class 7. Vibrating machines. D. F. Developments Ltd., 175 Piccadilly, W.1.

Auditec. 733,627. Class 9. Electronic sound detectors for use in industry in tracing faults. Bonochord Ltd., 48 Welbeck St, W.1.

Lyndock. 735,411. Class 9. Soldering irons. Lyndock Electrical Products Ltd., Old Netley Works, Portsmouth Rd, Sholing, Southampton.

Imcoy. 735,492. Class 17. Insulating tape. Isola Mfg Co., Harper Rd, Northenden, Chester.

BUSINESS PROSPECTS

Home

Ashby-de-la-Zouche U.D.C. Construction of 42 houses, 10 bungalows and 8 flats on Willesley Rd site. Pick, Everard, Keay and Gimson, 6 Millstone Lane, Leicester.
Bath. S. Western Hospital Board planning reinstatement and modernisation of Royal National Hospital for Rheumatic Diseases.
Bristol. Raleigh Industries Ltd. of Nottingham, planning to build branch premises in Emery Rd, on trading estate. Also, Fire and Safety Engineers Ltd. propose to erect factory at Barton Vale.
Brownhills (Staffs). Land to be leased to Castings Ltd., Walsall, for erection of factory to cost about £100,000. Factory will be in Lichfield Rd.
Carlisle. Rural Cinemas and Entertainments Ltd. are planning a new cinema.
Clogher (Tyrone) R.D.C. Erection of 25 houses at Crossowen. McCarthy and Lilburn, quantity surveyors, Scottish Provident Buildings, Donegall Sq West, Belfast.
Edinburgh. Dean of Guild Court has approved plans of W. and M. Duncan Ltd., Beaverhall Rd, to build warehouse and factory. Estimated cost, £100,000.
Hampstead T.C. Erection of two 4-storey blocks of 22 flats and maisonnettes. Town Clerk, Town Hall, Haverstock Hill, N.W.3.
Hemsworth (Yorks) R.D.C. Erection of 62 houses and 8 bungalows at South Elmsall. S. Price, Engineer and Surveyor, Brierley Hall, Brierley, nr. Barnsley.
Hull. Inclusion of main block of new college for further education in 1955-56 programme has been approved. Plans also approved for Great Field county primary school No. 1 costing £91,250, and Thanet county primary school's junior dept. to cost £55,204.
Huntingdonshire. New police stations to be built at Fletton and St. Neots at cost of about £75,000.

Trade Notes

Aluminium. The U.K. price of ingot aluminium was raised by £7 to £163 a ton on 1 Jan.
Changes of Address. The Riley Stoker Co. Ltd. have opened a new branch office at 43 Burton Rd, Melton Mowbray (telephone, Melton Mowbray 495), where their Midland area manager, Mr A. J. Salter, can be contacted.
The Birmingham sales offices of the Northern Aluminium Co., Ltd., are now at 14 Bennett's Hill, Birmingham, 2. Telephone, Midland 5236.
The Bournemouth branch office of the Hotpoint Electric Appliance Co. is now at 63 Holdenhurst Rd. Telephone No., Bournemouth 3593.
The Glasgow address of Smith's Industrial Instruments, Ltd., is now 123-145 North St, Glasgow, C.3. Telephone, Central 3972-8.
New Branch.—The London Electric Wire Co. and Smiths, Ltd., and its associated companies, Frederick Smith and Co., the Liverpool Electric Cable Co., Ltd., and Vactite Wire Co., Ltd., have opened branch offices and stores at Lewcos House Cardiff Rd, Reading.
Peruvian Imports. Among certain goods freed from import duty if imported into Peru for use in the domestic mining industry are electric alarm sirens, armatures, rotors, commutators and other parts of dynamos and motors.
Irthlingborough (Northants) U.D.C. It is proposed to erect 24 houses and 6 bungalows on Addington Rd estate, and 36 houses and 6 bungalows on Baker St site.
Lindsey. County council invite tenders for erection of secondary modern school at Skegness. Evans, Cartwright and Woollatt, 111 London Rd, Derby.
Melton Mowbray. Production Engineering Research Assoc. propose to erect research laboratories. Consultants are Husband and Co., 388 Glossop Rd, Sheffield.
Monmouthshire. Erection of secondary modern school at Croesyceiliog, nr. Newport. C. L. Jones, county architect, Queen's Hill, Newport.
Newbury T.C. Erection of 54 houses on Valley Rd estate. Borough Surveyor, Municipal Bldgs.
Newcastle-on-Tyne. Smith's Potato Crisps Ltd. planning new factory for which J. Stanley Beard, Bennett and Wilkin, 101 Baker St, London, W.1, are architects.
North Riding. Plans have been approved for county modern schools at Malton, Pickering, Wensleydale and Bedale included in next year's programme.
Nottingham T.C. Erection of 18 houses on Beechdale estate. City Housing Architect, The Guildhall.
Penrith U.D.C. Tenders being invited for erection of 74 houses on Scaws estate and 24 old people's houses at Elm Terr. Council architect is F. E. B. Blane.
Peterborough. Plans for factory extensions in Lincoln Rd, Walton, submitted by British Horticultural Co., Ltd.
Port Talbot T.C. Erection of 40 houses on Home Farm site, Baglan. C. V. Griffiths, Borough Engineer, Municipal Buildings.
Scunthorpe T.C. Allocation of 600 houses received for 1955.
Solihull. Rover Car Co. Ltd. are planning 100,000 sq ft factory. Architects are Hasker and Hall, 13 Welbeck St, London, W.1.
South Shields. Second stage of new Marine and Technical College is estimated to cost £115,000. Approval being sought. Architects are Meade, Taylor and Wilson, 17 Sheffield Terr, Camden Hill, London, W.8.
Stockton-on-Tees R.D.C. Construction of 24 houses at Preston-on-Tees and 4 bungalows at Longnowton. Surveyor, Cromer Lodge, Yarm Lane.
Sunderland. Drapery store of Jopling's to be rebuilt as soon as possible; it was destroyed by fire. Plans by S. W. Milburn and Partners, 9 Esplanade.
Wakefield T.C. Erection of 230 houses on Kettlethorpe estate, 12 flats at Lupset and branch library at Flanshaw. City Engineer, Town Hall.
West Lothian. Approval sought for scheme for 141 houses at Stewartfield, 159 at Hardhill, 60 at Seafield, 61 at Whiteside, and 16 each at Blackridge and Greenrigg.
Workington T.C. Construction of shops and offices in Oxford St, for Mr C. W. Murray. Architects are Oldfield, Simpson and Saul, National Provincial Bank Chambers.
Worcestershire. Construction of first instalment of secondary modern school at Wythall. Architects, S. T. Walker, 83 Suffolk St, Birmingham.

Overseas

South Africa. Tender and Supplies Board of Department of Posts and Telegraphs is preparing an approved list of tenders for supply of p.v.c. switchboard cable. Applications should be addressed to Controller of P.O. Stores, P.O. Box 447, Pretoria.
Trinidad. Mr Roy Wilson, director of Wilson and Johnstone Ltd., 3 Broadway, Port of Spain, is visiting this country and wishes to obtain agencies on commission basis for (among other items) domestic electrical appliances except carpet sweepers. Interested persons should write to Mr Wilson at 8 Orme Ct, London W.2.
Venezuela. Representation of U.K. manufacturers of radio communications equipment, electrical cables and components for radio receiver sets, being sought by Intelec, S.A., Edificio Industria, Puente Republica, Caracas.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

J. F. Hobson and Co., Ltd., 926 North Circular Rd, Cricklewood, N.W.2. General and electrical engineers, etc. Nom. cap.: £1,000. Dirs.: J. F. Hobson, W. E. Meyer, and A. J. Greaney.

Pinner Investments Ltd., Ranworth, 49 The Drive, Harefield Place, Uxbridge. Hire purchase financiers; and that of electrical engineers and contractors, wireless and television engineers, etc. Nom. cap.: £5,000. Dirs.: J. S. Taylor and Sheila M. Taylor.

S.E.D. (Cirencester) Ltd., Kent End Cottage, Ashton Keynes, Wilts. Manufacturers of and dealers in electronic equipment, etc. Nom. cap.: £100. Dirs.: W. R. Stephenson, Mrs M. E. Stephenson, and C. R. Churchill.

Streetly Sales (Staffs) Ltd., 108 Chester Rd, Streetley, Staffs. Manufacturers of and dealers in electrical and mechanical apparatus and accessories, wireless and radio sets, etc. Nom. cap.: £100. Dirs.: G. A. Harrison and G. E. Fentham.

Metind Ltd. Electrical engineers and electricians, mechanical and general engineers, manufacturers of and dealers in switchgear, control gear, etc. Nom. cap.: £100,000. Dirs.: Not named. Subs.: J. L. Hardie, 6 Ledcameroch Rd, Bearsden, Dumbartonshire; and H. E. R. Shand, 15 Thomson Drive, Bearsden.

Associated Electrical Industries Overseas Ltd. Nom. cap.: £1,000. Dirs.: To be appointed by subs. Subs.: G. E. Walker and B. W. Burnett, Crown House, Aldwych, W.C.2.

Hyradar Ltd., Grosvenor Mansions, 82 Victoria St, S.W.1. Manufacturers, distributing agents, consultants, designers and repairers of electrical apparatus of all kinds, etc. Nom. cap.: £2,500. Dirs.: R. E. Gordon and M. G. Fleet.

W. H. Smith (Eziot) Ltd., 32 Mansfield St, Leicester. To take over business of manufacturer of electrical water heaters, coppersmith, metal worker and general engineer carried on at Leicester by Wm. H. Smith. Nom. cap.: £10,000. Dirs.: W. H. Smith, Mrs F. M. Smith, and T. F. Stanley.

MEETINGS TO NOTE

THURSDAY, 6 JAN.

I.E.E. (London). "Problems of Hydro-Electric Design in Mixed Thermal-Hydro-Electric Systems," T. G. N. Haldane and P. L. Blackstone. Savoy Place, W.C.2, 5.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Merseyside). "Applications of Electronics to Photography," D. M. Neale. College of Technology, Byrom St, Liverpool, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (N. Western). Discussion on "Problems in Design and Production of Car Radio," C. L. Caiger. College of Technology, Sackville St, Manchester, 7 p.m.

CHELMSFORD ENGRNG. SOC. "Radio Navigational System for Ships and Aircraft," C. Powell. Social Hall of Hoffmann's, 7.30 p.m.

I.E.S. (Glasgow). "High Bay Lighting," F. Jones, 39 Elmbank Cresc., 7.30 p.m.

I.E.S. (Nottingham). "Recent Studies in Glare," R. G. Hopkinson and P. Petheridge. Elect. Offices, Smithy Row, 6 p.m.

FRIDAY, 7 JAN.

I.E.E. (N.E. Students). Problems Night at Grand Hotel, Newcastle, 6.30 p.m.

I.E.S. (Bath and Bristol). "Studies in Interior Lighting," J. M. Waldram. Royal Hotel, Bristol, 6.15 p.m.

INCORP. PLANT ENGRS. (Birmingham). "Gas Turbines in Industry," J. R. Needham. Imperial Hotel, 7.30 p.m.

SATURDAY, 8 JAN.

BIRMINGHAM ELECTRIC CLUB. Children's Party at Grand Hotel, 3 p.m.

MONDAY, 10 JAN.

I.E.E. (London). Discussion on "Atmospheric Pollution," G. R. Peterson. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Mersey and N. Wales). "Economic Selection of Cooling Towers for Generating Stations," G. F. Kennedy and P. H. Margen. Liverpool Royal Instn., Colquitt St, 6.30 p.m.

I.E.E. (N. Eastern). "Proving Performance of Circuit-Breakers," J. Christie, H. Leyburn and J. F. Bird; "New Research Station for High-Power Circuit-Breakers," J. Christie, H. Leyburn and R. W. Fenn; "Design and Constructional Features of 275 kV Special Duty Transformer Bank," E. C. Rippon. Neville Hall, Westgate Rd, Newcastle, 6.15 p.m.

I.E.E. (N.W. Utilisation). "Design, Performance and Application of Miniature Circuit-Breakers," H. W. Wolff and T. G. F. Atherton. Engrs. Club, Albert Sq, Manchester, 6.15 p.m.

I.E.E. (S. Midland Supply and Utilisation). "Brushless Variable-Speed Induction Motor," Prof. F. C. Williams and E. R. Laithwaite. Imperial Hotel, Birmingham, 6 p.m.

JUNIOR INSTN. OF ENGINEERS (Sheffield). "Heating of Houses," James Law. Livesey Clegg Hse, 7.30 p.m.

LEICESTER ELECTRICAL SOC. "Industrial Air Conditioning," L. G. W. Gosden. Elect. Offices, Charles St, 7 p.m.

NORTH-EAST ELECTRICAL CLUB. "Lighter Side of Public Life," Sir Edward Appleton. 98 Pilgrim St, Newcastle, 6.30 p.m.

ROCHDALE ELECT. TRADE TECH. SOC. "Back Projection Domestic TV Receivers," P. Conway. Electric Hse, Smith St, 7.45 p.m.

INCORP. PLANT ENGRS. (Dundee). "Fans and Fan Engineering," C. J. Atkins. Mathers Hotel, 7.30 p.m.

E.P.E.A. (London). "H.V. Porcelain Insulators," G. H. Gillam. Caxton Hall, S.W.1, 7 p.m

TUESDAY, 11 JAN.

I.E.E. (E. Midland). "Heat Pumps," J. A. Sumner, Loughborough College, 6.30 p.m.

I.E.E. (N.W. Supply). "Automatic Circuit Reclosers," G. F. Peirson, A. H. Pollard, and N. Core. Engrs. Club, Albert Sq, Manchester, 6.15 p.m.

I.E.E. (N. Ireland). "Control and Protective Circuits for Small Self-Exciting Induction Generators," J. R. W. Murland and R. L. Marrs. Queen's Univ., Belfast, 6.30 p.m.

I.E.E. (Rugby). "Development and Utilisation of Hydro-Electric Power in Uganda," J. M. Stock and J. C. Lithgow. College of Technology and Arts, 6.30 p.m.

INSTN. OF MECHANICAL ENGINEERS. Three papers on "Vehicle and Road Lighting," L. J. Davies, G. Grime and J. H. Nelson. 1 Birdcage Walk, Westminster, 4 p.m.

I.E.S. (London). "Fading and Related Effects associated with the Radiation from Light Sources," B. S. Cooper. Royal Soc. of Arts, John Adam St, W.C.2, 6 p.m.

INCORP. PLANT ENGRS. (Manchester). "Pulverised Coal Firing for Lancashire Boilers," V. Taylor. Engrs. Club, Albert Sq, 7.15 p.m.

INCORP. PLANT ENGRS. (Edinburgh) "Aspects of Fire Prevention," 25 Charlotte Sq, 7 p.m.

ELECTRICAL INDUSTRIES CLUB. Monthly luncheon. Guest speaker: Mr Forbes Jackson.

INSTN. OF ENGRNG. INSPECTION. "Cathode Ray Tubes," C. H. Gardner. Grand Hotel, Broad St, Bristol, 7.30 p.m.

WEDNESDAY, 12 JAN.

I.E.E. (London Radio). "Thermionic Valves of Improved Quality for Govt. and Industrial Purposes," E. G. Rowe, P. Welch, and W. W. Wright. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Mersey and N. Wales). "General Survey of Helicopters," J. S. Shapiro. 24 The Temple, Dale St, Liverpool, 6 p.m.

I.E.E. (N. Scotland). "Distortions and Transitions in Atomic Nucleus," C. Strachan. Caledonian Hotel, Aberdeen, 7.30 p.m.

I.E.E. (Southern). "Mechanical Aspects of Aircraft Generation Equipment," W. R. Hinton. University, Southampton, 6.30 p.m.

I.E.E. (Oxford). "Future of Electronics in Industry," E. R. Davies, Elect. Offices, 37 George St, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (N. Eastern). President's address by Rear-Admiral (L) Sir Philip Clarke. Neville Hall, Westgate Rd, Newcastle, 6 p.m.

BRITISH INSTN. OF RADIO ENGRS. (W. Midlands). "Electronics in Materials Handling," L. Landon Goodman. Technical College, Wulfruna St, Wolverhampton, 7.15 p.m.

BRITISH INSTN. OF RADIO ENGRS. (S. Wales). "Electronic Counting Devices," F. H. Gage. Glamorgan Technical College, Treforest, 6.30 p.m.

BELFAST ASSOC. OF ENGRS. "Evolution of Mechanical Power Farming," John Chambers. College of Technology, 7.30 p.m.

MIN. OF WORKS LECTURE (Liverpool). "Thermal Insulation of Buildings," J. M. Boardman. College of Technology, Byrom St, 7.15 p.m.

INCORP. PLANT ENGRS. (Leicester). "Fans and Air Conditioning and Axial-flow Fans," R. H. Holbeche. College of Art and Technology, The Newarkes, 6.30 p.m.

INCORP. PLANT ENGRS. (E. Midlands). "Gas Turbines applied to Traction Vehicles," P. A. Phillips. Adult Educ. Centre, Shakespeare St, Nottingham, 7 p.m.

E.I.B.A. (N. Metropolitan branch). Annual meeting at Northmet Hse, Southgate, N.14, 3 p.m.

THURSDAY, 13 JAN.

I.E.E. (N. Midland). Chairman's address by W. A. Crocker. Elect. Offices, Ferensway, Hull, 7.15 p.m.

I.E.E. (N. Scotland). "Distortions and Transitions in Atomic Nucleus," C. Strachan. Univ. College, Dundee, 7 p.m.

I.E.E. (S. Western). "Some Design Features of Semi-Outdoor Power Station at Ince," F. H. S. Brown. Rougemont Hotel, Exeter, 3 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Scottish). Discussion on "Channel 3 Commercial T.V." 39 Elmbank Crescent, Glasgow, 7 p.m.

DERBY ELECTRICAL SOC. "Industrial Electric Furnaces," E. May. Elect. Showrooms, Irongate, 7 p.m.

E.I.B.A. (N. Counties). Annual meeting at Carliol Hse, Newcastle, 3 p.m.

FRIDAY, 14 JAN.

I.E.E. (N. Staffs). "Development and Utilisation of Hydro-Electric Power in Uganda," J. M. Stock and J. C. Lithgow. Elect. Showrooms, Stoke-on-Trent, 7 p.m.

INSTN. OF MECHANICAL ENGINEERS. James Clayton lecture: "Theory of Plasticity: Recent Achievements and Future Problems." William Prager.

I.E.S. (Birmingham). Annual dinner at Midland Hotel.

MIN. OF WORKS LECTURE (Whitehaven). "Powered Hand Tools." A. F. Coare. Howgill St School, 7 p.m.

Gazette Announcements

COMPANIES ACTS

L. P. Fox and Co., Ltd. Liquidator, E. S. Browne, of 41 North John St, Liverpool, released as from 6 Dec.

BANKRUPTCY ACTS

Public Examination

London. Richard W. Hembrow, electrical engineer, of 47 St. Marys Rd, Ealing, W.5. Public exam will be at Bankruptcy Buildings, Carey St, W.C.2, on 16 Feb. at 11 a.m. First meeting took place on 31 Dec.

Intended Dividends

Barnstaple. George R. Rosvall, electrician, trading at The Corner Hse, St. Giles, Torrington. Last day for receiving proofs, 8 Jan. Trustee is G. W. Sisman, Official Receiver, 12 Pennsylvania Rd, Exeter.

Blackburn. Frank Lockett, electrician trading at 10 Blackburn Rd, Gt Harwood. Last day for receiving proofs, 14 Jan. Trustee is R. C. Baldwin, Bank Chambers, 2 Lord St West, Blackburn.

Dividends

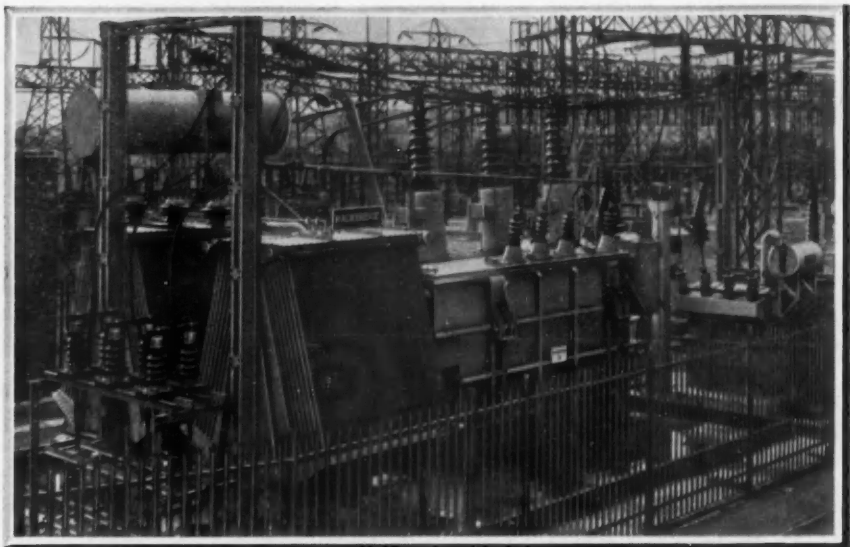
Guildford. Ronald H. Winslade, electrical engineer, of 21 Park Rd, Aldershot. First and final dividends of 2s. 1¼d. in £ payable tomorrow (Friday) at 11-12 Finsbury Sq, London, E.C.2.

Bristol. Anthony G. Dunn, electrician trading at The Bungalow, Water Lane, and 3 Glen View Rd, Brislington. First and final dividends of 20s. in £ payable on 11 Jan. at Official Receiver's Office, 26 Baldwin St, Bristol.

Orders Annulled, etc.

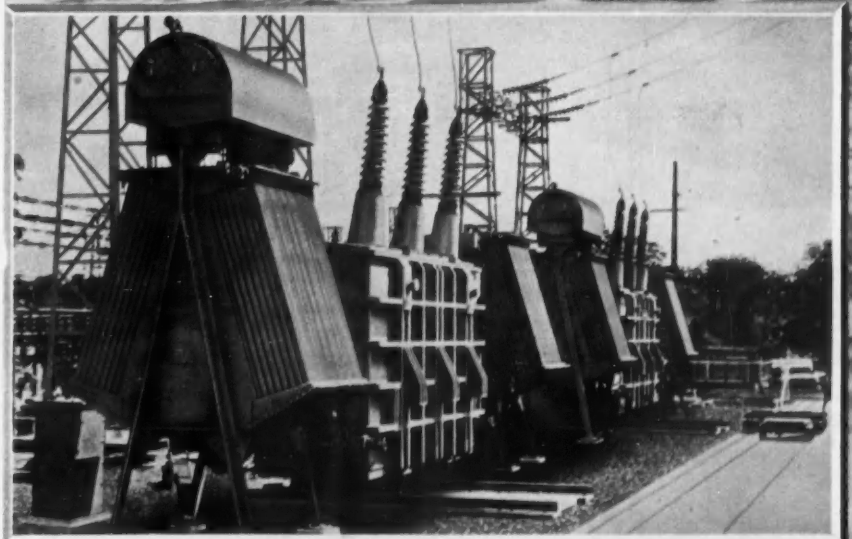
Bristol. Anthony G. Dunn, electrician, trading at The Bungalow, Water Lane, and at 3 Glen View Rd, Brislington, Bristol. Order of adjudication dated 1 Apr., 1954, annulled, receiving order dated 29 Mar. rescinded and petition filed on 13 Mar. dismissed as from 17 Dec. on grounds that there were sufficient funds with Official Receiver to pay debts in full.

London. Richard Hembrow, electrical engineer, 47 St Mary's Rd, Ealing, London, W.5. At first meeting of creditors it was reported that debtor's liabilities amounted to about £900 and he had assets of £3. No resolution was passed and matter was left in hands of Official Receiver as trustee of the estate.



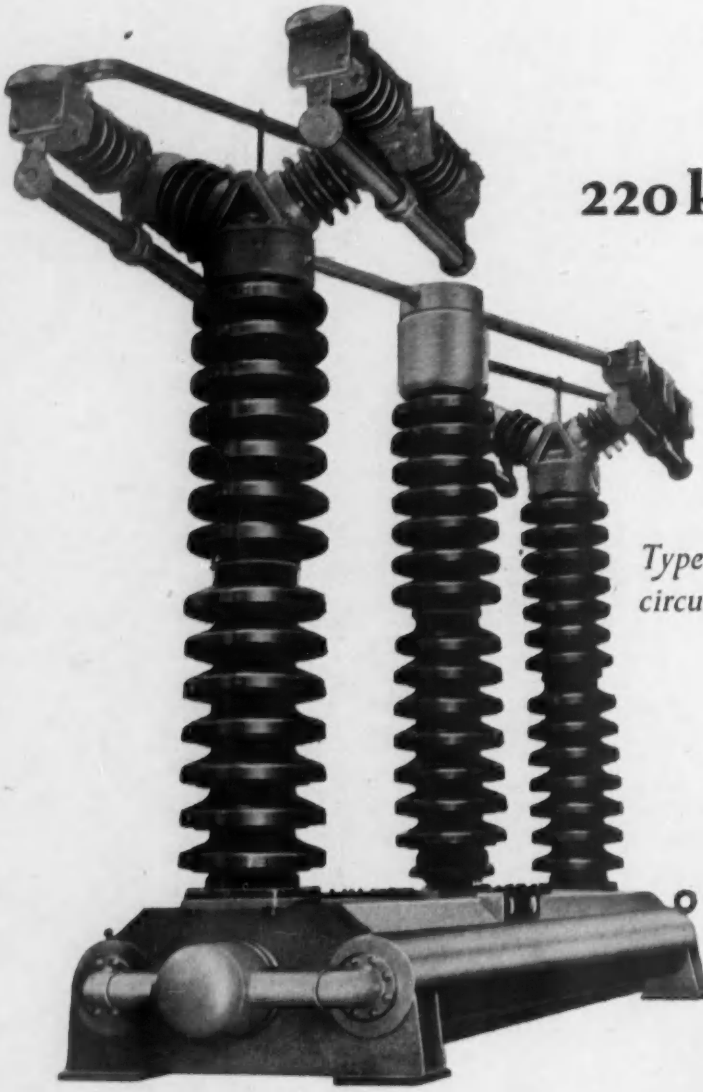
A 45,000 kVA 132/33 kV type ON/OFB transformer at Northfleet. This is one of twelve similar Hackbridge units supplied to the British Electricity Authority.

HACKBRIDGE TRANSFORMERS *Home and Abroad*



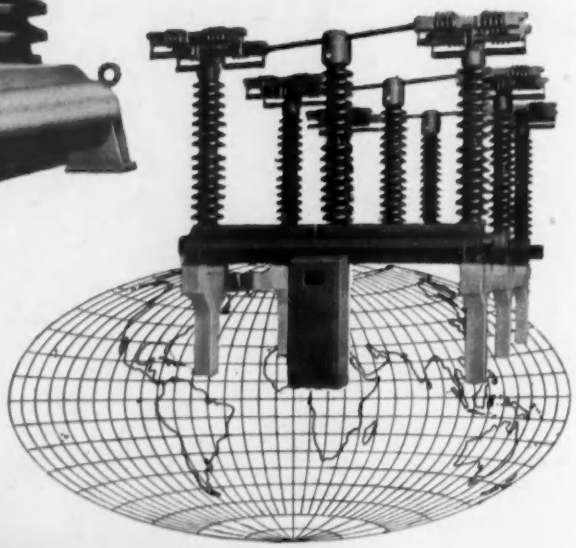
Two of the five 30,000 kVA 132/33 kV type ON/OB Hackbridge transformers supplied to the Department of Railways, New South Wales.

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 760 (8 lines) *Telegrams: "Electric, Walton-on-Thames"*



220 kV to 300 kV

Type GA Multi-break air-blast circuit-breaker.



- Originally designed for the new 275-kV. British network, but now being extensively supplied for overseas.
- Over 70 equipments now in service or under construction.
- Breaking capacities from 5,000 to 10,000-MVA.
- Available for high-speed single-phase and 3-phase reclosure.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the A.E.I. group of companies

Leading Electrical Progress

F/A403

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

RUNCORN RURAL DISTRICT COUNCIL

GROUP "A" STREET LIGHTING—TRUNK ROADS

TENDERS are invited for the supply and installation of reinforced or pre-stressed concrete columns and bracket arms, steel columns and bracket arms, a "catenary suspension section" on steel columns, lanterns and all auxiliary gear for lighting to Group "A" Standard by horizontal burning Mercury Vapour lighting equipment on:

(*a*) Trunk Road A.56—Bridge Lane, High St and Main St, Frodsham (approx. 2,200 yards).

(*b*) Trunk Road A.56—Chester Rd, Helsby (approx. 2,300 yards).

Specifications, bills of quantities and forms of tender may be obtained from, and the general conditions of contract and plan seen at the office of the Engineer and Surveyor, Castle Park, Frodsham, via Warrington, on payment of a deposit of Two Guineas (by cheque, made payable to this Council) which will be returned on receipt of a bona fide Tender not subsequently withdrawn and the return of all tendering documents.

Tenders in plain sealed envelopes, endorsed "Tender for Street Lighting" must be delivered to the undersigned not later than Saturday, 29 Jan., 1955.

The lowest or any tender will not necessarily be accepted and the Council reserve the right to place separate contracts for each installation.

R. PATRICK WILLIAMS,
Clerk of the Council.

Council Offices,
Castle Park, Frodsham,
via Warrington. (P 351)

CITY OF BELFAST
Electricity Department

STORES

TENDERS are invited for the supply of the undermentioned materials:

Form No.

1. Turbine Oil.
3. Firebricks, Fireclay and Binding Cement for High Temperature Furnace Requirements.
8. Glazed Stoneware Ducts and Troughing, and Covering Tiles.
9. Feeder, Section and Street Lighting Control Pillars.
13. Time Switches.
15. Distribution Transformers.
17. Thermostats for Domestic Electric Cookers and Immersion Heaters.
18. Electric Washboilers.
19. Electric Kettles.
22. Bare Hard Drawn H.C. Copper Conductors, P.B.J. and P.V.C. Insulated Cables.
24. Transformer Kiosks with High and Low Tension Switchgear.
28. Bitite Strip, Prepared Tape and Rubber Tape for Joints, Joint Box Compounds and Refined Bitumen.

continued in next column

continued from previous column

31. Oilskin Coats, Tarpaulins, Rubber Jointing, etc.
32. Electric Water Heating Equipment.
36. Electric Cooker Circuit Accessories.
37. Boiling Plates for Electric Cookers.

NOTE.—Form No. 31 is in respect of materials which shall be supplied to any Department of the Corporation.

Forms of Tender may be obtained from the Electricity Department, East Bridge St, Belfast, on payment of the sum of Ten Shillings (non-returnable) for each form. Extra copies of the forms may be obtained at Five Shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee" and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 28 Jan., 1955.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
(P.O. Box 234)
29/12/54. (P 370)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

BREADALBANE TRANSMISSION
33 KV SWITCHGEAR FOR DALCHONZIE SUBSTATION

TENDERS are invited for the provision of Outdoor 33 kV Switchgear and Ancillary Equipment for the above-mentioned Substation. Copies of the Tender Document may be obtained on application with a cheque for £2. 2s. (returnable), to the Engineers, Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1.

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Ter,
Edinburgh 3. (P 357)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

BREADALBANE PROJECT 132 KV AND 11 KV SWITCHGEAR FOR ST. FILLANS POWER STATION

TENDERS are invited for the provision of Outdoor 132 kV Switchgear and 11 kV Indoor Switchgear for the above-mentioned Power Station. Copies of the Tender Documents (for either or both Contracts) may be obtained on application with a cheque for £2. 2s. (returnable), to the Engineers, Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1.

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Ter,
Edinburgh 3. (P 307)

COUNTY BOROUGH OF SWANSEA

TENDERS FOR MATERIALS AND HAULAGE

TENDERS are invited for the undermentioned for a period of twelve months from 1 Apr., 1955:

Bitumastic Macadam.
Bricks.
Brushes for Motor Sweeper (Refills).
Bunting.
Cement.
Concrete Kerb.
Concrete Paving.
Concrete Tubes, etc.
Concreting Material.
Engineering Supplies.
Granite Chippings.
Gullies and Frames (C.I.).
Haulage—Motor Day.
Haulage—Tonnage.
Iron and Steel.
Lamp Pillars, Steel
Lamp Pillars, Concrete.
Lamps, Electric.
Limestone.
Manhole Covers and Frames.
Mortar.
Oils.
Petrol and Diesel Oil.
Pipes. (Salt Glazed.)
Public Lighting Equipment.
Rubber Hose Pipe.
Sand and Gravel.
Slag and Ashes (Supply and Dely.)
Tar or Proprietary Compounds.
Tarmacadam.
Tools and Implements.
Tyres and Tubes.
Walling Stone.
Waste.

Forms of Tender and further particulars may be obtained from the Borough Engineer and Surveyor, Guildhall, Swansea.

Tenders, in envelopes sealed and endorsed "Tender for ....." but which must not bear any name or mark indicating the sender, must be deposited with the undersigned, either by hand (and receipt obtained) or by registered post, on or before 5 Feb., 1955.

The lowest or any Tender will not necessarily be accepted.

T. B. BOWEN,
Town Clerk.

The Guildhall,
Swansea. (P 279)

BOROUGH OF YEOVIL

STREET LIGHTING—LARKHILL HOUSING ESTATE

TENDERS are invited for the provision and erection of 36 No. 15 ft mounting Height Steel Columns complete with 100 W Tungsten Lamps, Lanterns and all necessary equipment on the above mentioned estate.

Contract documents may be obtained from and drawings inspected at the office of the undersigned. Sealed tenders in the official envelope provided must reach the Town Clerk not later than 9 a.m. on Friday, 28 Jan., 1955.

The Council do not bind themselves to accept the lowest or any tender.

A. HEAL, M.I.MUN.E.,
Borough Surveyor.

Municipal Offices,
King George St, Yeovil. (P 369)

GOVERNMENT OF KUWAIT
Department of Electricity
Power Station "B"

TENDERS are invited for the supply C.I.F. and erection of 33,000 V Indoor Type Metalclad Switchgear, all Control Room Equipment and Alternator Pit Equipment for four 10,000 kW Alternators for the above new Power Station. The Tender Documents will be available in Kuwait on 31 Jan., 1955. A single copy of the Tender Documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti Agents. The necessary additional copies of the Tender Documents will be issued by the Consulting Engineers in London on receipt of the Authorisation Form from the Government of Kuwait. Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on 13 Jan., 1955. The Tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by 18 Mar., 1955.

Ewbank and Partners Ltd.,
Engineering Consultants.

10/11 Grosvenor Place,
London, S.W.1. (P 371)

BOROUGH OF WANSTEAD AND WOODFORD
DISTRICT ROAD LIGHTING (GROUP B)

TENDERS are invited for the installation of 160 W blended lighting in 29 roads within the Borough, amounting to approximately 270 units.

Tender documents may be obtained from the Borough Engineer, Municipal Offices, Woodford, E.18, upon payment of Two Guineas deposit which will be returned upon receipt of a bona fide tender.

Sealed tenders to be delivered by noon on Friday, 21 Jan., 1955. (P 308)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the position of SENIOR DRAUGHTSMAN (Electrical) in the Construction Department.

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Grade 4 (£750 x £20—£850 per annum) or Grade 5 (£640 x £20—£740 per annum) of Schedule D according to experience.

Closing date for receipt of applications, 13 Jan., 1955.

The appointment will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy No. 188/54/ET.

L. F. JEFFREY,
Divisional Controller.
(P 302)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Ayrshire Sub-Area

APPLICATIONS are invited for the undernoted Engineering appointments.

(a) THIRD ASSISTANT ENGINEER (SHIFT CONTROL)—SUB-AREA HEADQUARTERS, KILMARNOCK

The duties, which will be carried out in accordance with a continuous shift rota, will comprise switching operations, voltage regulation, the recording of data, etc., in connection with the control of an extensive 33 kV and 11 kV distribution system.

Salary: N.J.B. Agreement—Class "G," Grade 10, £675/£720 per annum.

(b) GENERAL ASSISTANT DISTRICT ENGINEER—AYR DISTRICT

Applicants should preferably possess a Higher National Certificate in Electrical Engineering or its equivalent and have experience of operational work in an Electricity Supply Authority.

Salary: N.J.B. Agreement—Class "E," Grade 11, £555/£600 per annum.

The above appointments are superannuable. Applicants should include in their application full details of technical training, qualifications and experience.

Forms of application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me, duly completed, with any additional information not later than 10 Jan., 1955.

A. E. ROOTS,
Manager.
Greenholm St,
Kilmarnock.
22 Dec., 1954. (P 303)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following position:

JUNIOR ENGINEERS
S/13.603

Applicants should have served an apprenticeship or had practical training suitable to the Industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for junior engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include as a general rule, the operation and control, under supervision, of generating plant.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Commencing salary within range £475/£590 (N.J.B.), depending on qualifications, experience and position to which appointed.

Special application forms obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned as soon as possible. Please quote ref. ET. (P 372)

EASTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEERS

(i) BARNET District, Northmet Sub-Area (Ref. 510) 185/54R.
(ii) Hornsey District, Northmet Sub-Area (Ref. 512) 186/54R.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. distribution systems (including substations).

Salary for both appointments will be in accordance with the National Joint Board Salary Agreement as follows:

(i) Class E, Grade 9, commencing at £635.
(ii) Class F, Grade 9, commencing at £675.

Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the appropriate District Manager within fourteen days of the appearance of this advertisement.

Addresses of District Managers are as follows:

(i) The District Manager, Eastern Electricity Board, 7c High St, Barnet, Herts.
(ii) The District Manager, Eastern Electricity Board, The Broadway, Crouch End, London, N.8. (P 359)

LONDON ELECTRICITY BOARD
DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for the above position in the West Ham District of the North Eastern Sub-Area.

The person appointed will be responsible for the commercial organisation and development of the District, and applicants should have had experience in commercial development of electricity supply; control of Service Centres, sales and staff; administration and operation of hire and hire-purchase schemes, and control of an electrical contracting and maintenance department and staff.

The post is graded under Schedule "A" of the National Joint Board Agreement as Class G, Grade 3—£1,085 per annum, rising to £1,175 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed by 15 Jan., 1955. Please enclose addressed envelope and quote ref.: V/1729/T on all correspondence. (P 300)

SOUTH EAST SCOTLAND ELECTRICITY BOARD
Southern Sub-Area

METER REPAIRER (Mechanician). N.J.I.C. conditions. Rate 45d. per hour.

Applications stating age, experience and present employment to reach the Board at High St, Galashiels, by 17 Jan., 1955. (P 344)

CITY COUNCIL OF SINGAPORE
Electricity Department

APPLICATIONS are invited for the post of JUNIOR TECHNICAL ASSISTANT in the City Electricity Department on 3 years' agreement in the first instance. On satisfactory completion of the agreement the appointee would normally be offered emplacement on the permanent establishment.

Applicants must be Graduate members of the Institution of Electrical Engineers or possess the Higher National Certificate (Electrical) or equivalent. They must also have experience in Technical planning of High and Low Voltage transmission and Distribution Networks, substations, Transformers and Switchgear, etc., and knowledge of High Voltage Generating Plant and Control equipment. Minimum age: 28 years.

The salary offered is $870, $910, $950 a month for the 1st, 2nd and 3rd year respectively in the salary scale $870 x A40—990. Expatriation and Cost of Living Allowances are also payable.

If placed on the permanent establishment after satisfactory completion of the Agreement the basic salary will be $990 per month in the scale $870 rising to $990 per month (£1,218 to £1,386 per annum).

Expatriation Allowance payable is £315 per annum on basic salary of $870 a month and £343 per annum on basic salary between $871 and $990 a month.

Cost of Living Allowance payable at present is £238 per annum on basic salary between $870 to $910 a month and £224 per annum on basic salary between $950 and $990 a month for a single man; £385 per annum on basic salary between $870 and $990 a month for a married man; £560 per annum on basic salary between $870 and $990 a month for a married man with one or more children. A dependent child means an unmarried child, including a step child or a legally adopted child, under the age of 17, or receiving full-time educational instruction and below the age of 21.

For a single man the minimum total emoluments on a basic salary of $870 a month would amount to £1,771 per annum; for a married man with no children £1,918 per annum and for a married man with one or more children £2,093 per annum.

The exchange rate is approximately $1 to 2s. 4d. sterling.

Partly furnished quarters provided, if available, at 6% of basic salary or Housing Allowance of 10% of basic salary (subject to a maximum of $120 per month) paid in lieu.

Free passages will be provided for appointee, his wife and his own children under the age of 12 years at the date of sailing subject to a maximum of three full passages.

One month leave per year of service may be granted on satisfactory completion of agreement at the discretion of the Council. If placed on the permanent establishment on completion of the agreement the appointee will be required to serve a further year before proceeding on leave. The present rate of leave is 4 days per month of resident service. Local leave of 14 days a year cumulative to a maximum of 28 days may also be granted.

Compulsory Provident Fund contributions at present 7½% of salary (but not allowances) to which the Council donate 7½% rising to 10% after 10 years' service, 15% after 15 years' service, and 20% after 20 years' service. This scheme is under review.

Further details from the Council's Agents: Messrs Allen and Williams, 1 Victoria St, Westminster, London, S.W.1. Full applications in duplicate to be submitted before Tuesday, 18 Jan., 1955. (P 296)

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

SENIOR ASSISTANT ENGINEER required. Candidates must be Corporate Members of the Institution of Electrical Engineers with wide experience of the various forms of electrical work found in all types of hospital accommodation, including lifts, telephones, call systems and all systems of conduit work and have the ability to negotiate suitable tariffs with the Supply Authority, be capable of preparing specifications and designs, etc., and organising the running of an Electrical Section. Salary £875 x £30—£1,025 plus £40—£50 London Weighting. Improved scale expected shortly.

Apply, giving age, qualifications and experience, with names of two referees to Secretary, North West Metropolitan Regional Hospital Board, 11a Portland Place, W.1, by 24 Jan., 1955. (P 358)

CITY OF SALISBURY
Southern Rhodesia

VACANCY FOR ELECTRICAL ENGINEER, SALARY SCALE £1.450 BY £50—£1.600. (PROFESSIONAL OFFICER, GRADE 3.)

APPLICATIONS are invited for the position of an Electrical Engineer (Professional Officer Grade 3), in the salary scale £1,450 x £50—£1,600 per annum.

Candidates should possess a degree in Electrical Engineering or the equivalent, and/or be corporate members of the British Institution of Electrical Engineers, and have had at least 15 years' experience in the design, erection and maintenance of indoor and outdoor substations, transformers, switchgear, protection, etc., up to and including 33,000 V.

The position is a senior post and the selected candidate will be in charge of the substation section of the Distribution Department of an undertaking covering approximately 700 sq miles, and some 690 substations, with a present system maximum demand of 70 MW; experience in general distribution work and in the control of staff in an organisation of at least similar size is essential.

The appointment will be subject to Council's Service and Leave Regulations, which will be made available for inspection at the offices of the undersigned. The salary payable will commence at the minimum of the above scale, and rise by annual increments to the maximum; no cost of living or other allowances are payable.

The successful candidate must be able to comply with the regulations of the Southern Rhodesian Immigration Authorities, and will be required to submit a satisfactory medical certificate of fitness.

Applicants are requested to submit full particulars of their qualifications, training, and experience, giving details of positions held and salaries received, marital state, age, place of birth, and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the cover, must reach the offices of the undersigned, from whom further particulars can be obtained, on or before 22 Jan., 1955. Airmail paper should be used.

Davis and Soper Ltd.,
London, E.C.3. 52-54 St. Mary Axe.
22 Dec., 1954. (P 284)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED SENIOR ENGINEERING DRAUGHTSMAN and ENGINEERING DRAUGHTSMAN in the Eastern Sub-Area of the Board at Cwmbran.

Salary—Senior Engineering Draughtsman, Grade 5 (£640/£740); Engineering Draughtsman, Grade 6 (£510/£630) of Schedule D of N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary, to arrive by 15 Jan., 1955.

D. G. DODDS,
St. Mellons, Secretary.
Cardiff. (P 361)

LONDON ELECTRICITY BOARD
SENIOR DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area at Aldersgate, London, E.C.1.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations for the alteration of existing premises and the conversion of basements into substations and transformer chambers. Experience in the lay-out of electrical equipment up to 11 kV, whilst not essential, would be an advantage.

The post is graded under Schedule "D" of the National Joint Board Agreement as Grade 5, commencing salary within range £672 to £777 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within ten days of the publication of this advertisement. Please enclose addressed envelope and quote ref.: V/1692/T on envelope and all correspondence. (P 301)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of DISTRICT MANAGERS in each of the Districts as follows in the Board's No. 4 Sub-Area:

Wrexham, Crewe, Rhuddlan, Conway, Caernarvon, Oswestry, Anglesey, Aberystwyth.

Applicants, who should have a wide experience of the Electricity Supply Industry, should submit only one application form indicating the post or posts for which they wish to be considered.

The salaries payable will be:

Wrexham District, N.J.M. Scale 3, £1,450/£1,600 p.a.

Crewe, Rhuddlan, Conway, Caernarvon, Oswestry Districts, N.J.M. Scale 2, £1,300/£1,450 p.a.

Anglesey, Aberystwyth Districts, N.J.M. Scale 1, £1,150/£1,300 p.a.

The appointments are superannuable and subject to medical examination.

Application forms may be obtained from the Establishments Officer, Electricity House, Love Lane, Liverpool 3, and should be returned in sealed envelopes endorsed "District Managers," addressed to the Secretary of the Board at the same address. Closing date: 22 Jan., 1955.

M. M. PARKER, Secretary.
(P 335)

WAR OFFICE

VACANCIES exist for basic grade draughtsmen, mechanical and basic grade draughtsmen electrical engineering, in the designs branch of the Directorate of Fortifications and Works, War Office, Chessington, Surbiton, Surrey.

MECHANICAL DRAUGHTSMEN—(Heating and Ventilating)—applicants must have considerable knowledge and experience in design of low-pressure hot water heating and domestic hot water supply installations. Ordinary National Certificate in Mechanical Engineering or equivalent is an advantage.

ELECTRICAL ENGINEERING DRAUGHTSMEN—Applicants must have had several years' experience in the preparation of schemes for the illumination and electrical equipment of buildings or in electrical distribution H.V. and M.V. Ordinary National Certificate in Electrical Engineering or equivalent is essential.

All applicants must be British of British parentage.

Salary range is £390 (may be somewhat less if under age 21)—£655 plus overtime. Starting pay according to age, qualifications and experience, with annual increases subject to satisfactory service. Prospects of promotion and establishment. Canteen facilities.

State age, full details of training and experience to Secretary of State for War, War Office (C.5.A), R. 503, Northumberland House, W.C.2. (P 349)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions:

JUNIOR ENGINEER,
LEICESTER POWER STATION
Vacancy No. 185/54/ET

Some experience in Control Room and Boiler House work in a large P.F. Station is required. Technical qualifications up to Higher National Certificate.

Salary in accordance with Class H, Grade 16 (£475 by £15—£520 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 19 Jan., 1955.

SENIOR DRAUGHTSMAN (ELECTRICAL)
CONSTRUCTION DEPARTMENT, DIVISIONAL H.Q.
Vacancy No. 188/54/ET

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Grade 4 £750 by £20—£850 per annum) or Grade 5 (£640 by £20—£740 per annum) of Schedule D according to experience.

Closing date for receipt of applications, 13 Jan., 1955.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the dates stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
31 Dec., 1954. (P 367)

IMPERIAL CHEMICAL INDUSTRIES LIMITED
Wilton Works
ENGINEERS

FEW post war industrial developments have been conceived on the scale of continuous expansion of the Wilton Works of Imperial Chemical Industries.

This modern factory provides opportunity for young men of ability in many fields of engineering. Previous experience in the chemical industry is not essential but applicants should have had one or more years' industrial experience including practical training, and men with a good Honours Degree are preferred. There are openings in most engineering fields including design and layout, construction, plant operation and maintenance for MECHANICAL and ELECTRICAL ENGINEERS, who will find ample scope for promotion leading to executive positions.

Appointments are to the permanent staff with first-class working conditions including Pension Fund and Recreation facilities.

Write for application form to Staff Officer, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting advertisement reference ICI/X/204/C. (P 294)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED ASSISTANT CHIEF COMMERCIAL OFFICER (Industrial Supplies), Commercial Department, Head Office, St. Mellons, Nr. Cardiff.

Applicants should be suitably qualified with a wide experience in the utilisation of electricity in light and heavy industries and in the negotiation of industrial supplies of electricity.

Salary—Scale 3 (£1,450 x £50—£1,600) of N.J.M. and H.E. Grades.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 22 Jan., 1955.

D. G. DODDS,
St. Mellons, Secretary.
Cardiff. (P 297)

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

SECOND ASSISTANT ENGINEER (LARGE POWER SALES & GENERAL DEVELOPMENT)

APPLICANTS must be conversant with all matters connected with the commercial organisation of an industrial district or Sub-Area and have experience in tariff interpretation, negotiations with large power consumers, and in general development work.

Salary—N.J.B. Class K, Grade 7, £975/£25/£1,050 per annum.

Castleford District

SECOND ASSISTANT DISTRICT ENGINEER

Applicants must be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They must have had a sound practical training and extensive experience in the design, construction, operation and maintenance of H.V. and M.V. overhead and underground distribution systems, substation plant and ancillary equipment, preferably in a large undertaking.

Salary—N.J.B. Class F, Grade 7, £755/£15/£800 per annum.

Barnsley District

THIRD ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants should hold a current driving licence, and must be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary—N.J.B. Class F, Grade 9, £675/£15/£720 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 20 Jan., 1955.

No. 3 (Sheffield) Sub-Area

GENERAL ASSISTANT ENGINEER (OPERATIONAL CONTROL)

Applicants should have had a good general and technical education, and should preferably have passed the Graduate Membership examination of the Institution of Electrical Engineers and have had operational experience on a large electricity supply system. The successful applicant will be expected to take charge of the Sub-Area Control Room during his shift, working on a five man shift rota. During this period of duty he will be expected to carry out emergency operational switching on a heavy industrial part of the system in the Sheffield City area. His duties will include the control of all switching carried out by Engineers in the Sub-Area during his period of duty.

Salary—N.J.B. Class M, Grade 13, £755/£15/£800 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 20 Jan., 1955.

Head Office

Chief Engineer's Department

THIRD ASSISTANT ENGINEER

The successful applicant will be required to assist generally in the design and construction of overhead lines.

Previous experience in the design and construction of high voltage overhead lines is essential and some knowledge of underground cable work will be an advantage.

Applicants should preferably be Corporate Members or Graduates of the Institution of Electrical Engineers or possess an equivalent qualification.

Salary—N.J.B. Schedule C, Class AX-EX, Grade 4, £750/£25/£875—£975 per annum.

ENGINEERING DRAUGHTSMAN

Required for overhead line surveys and

continued in next column

continued from previous column

to assist generally with survey work. Previous experience in survey work is essential.

Salary—N.J.B. Schedule D, Grade 6, £510/£20/£630 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than 20 Jan., 1955.

No. 4 (Leeds) Sub-Area

Leeds District

GENERAL ASSISTANT DISTRICT ENGINEER (LEEDS SOUTH)

Applicants should preferably be Graduates of the Institution of Electrical Engineers and have experience in the construction, operation, maintenance and planning of overhead and underground distribution systems in densely populated industrial and residential areas.

The successful applicant must be prepared to reside within the District and undertake standby duties, if required.

Salary—N.J.B. Class J, Grade 11, £715/£15/£760 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, near Leeds, not later than 20 Jan., 1955.

No. 7 (Grimsby) Sub-Area

Grimsby District

JUNIOR ENGINEER (INSTALLATION AND CONTRACTING)

Applicants should have technical training and preference will be given to those possessing the Ordinary or Higher National Certificate in Electrical Engineering. The successful applicant will be required to assist the Assistant Installation Engineer in the supervision of domestic, agricultural and industrial installation work including the preparation of estimates and tenders.

Salary—N.J.B. Class F, Grade 14, £475/£15/£520 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 20 Jan., 1955. (P 350)

INSPECTOR OF WORKS (ELECTRICAL)

required by the PUBLIC WORKS DEPARTMENT, NIGERIA NORTHERN REGION, on temporary contract for one tour of 18-24 months in the first instance. There is a prospect of transfer to the permanent establishment when a vacancy occurs. Salary scale (including expatriation pay) £807 rising to £1,115 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Candidates must have served a regular apprenticeship to electrical engineering and have had at least five years' responsible experience in electrical contracting work. A. C. and G. Certificate in Electrical Installation work would be an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40572/EE. (P 304)

COUNTY BOROUGH OF CROYDON

ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited for this appointment from qualified electrical engineers experienced in designs, specifications and supervision of new electrical works and the maintenance of installations. Street lighting experience would be an advantage.

Salary on the scale £1,097. 10s. per annum rising by increments of £52. 10s. per annum to £1,307. 10s. per annum.

Appointment is pensionable subject to medical examination.

Applications on forms obtainable from the Borough Engineer, Town Hall, Croydon. Closing date 17 Jan., 1955.

E. TABERNER,
Town Clerk.
(P 331)

SOUTH EASTERN ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

Dover District

SALARY £475 by £15—£520 under N.J.B. Class D, Grade 12. Superannuable. Applicants should hold the Higher National Certificate or its equivalent and have had a sound training in electrical engineering and in the operation and maintenance of underground and overhead systems up to 11 kV.

Applications, naming 2 referees to R. G. Widgery, A.M.I.E.E., District Manager, SEEBoard, Ladywell, Dover, Kent, by 19 Jan., 1955.

JOINTER

Crawley District

Wages 3s. 7d. per hour for 44-hour, 5-day week, under N.J.I.C. Agreement. It is possible that housing accommodation can be provided.

Applications, naming 2 referees to F. A. Avery, A.I.E.E., District Manager, Crawley District, SEEBoard, 55 High St, Crawley, by 19 Jan., 1955.

A. L. BURNELL,
Secretary.
(P 363)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

1. ASSISTANT SECTION ENGINEER in the Liverpool North District. Salary £715/£760 p.a. (N.J.B. G/9). Applicants should have had operational experience of H.T. and L.T. networks, including substations. Application forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3.
2. ASSISTANT SECTION ENGINEER in the Northwich District. Salary £635/£680 p.a. (N.J.B. E/9). Preference will be given to candidates with experience in H.T. and L.T. overhead and underground distribution work. Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire.

Applicants for both the above posts must have received a thorough technical training, and should possess the qualifications to enable them to become Chartered Electrical Engineers. Closing date: 17 Jan., 1955 (P 336)

LONDON ELECTRICITY BOARD

ARCHITECTURAL DRAUGHTSMEN

APPLICATIONS are invited for the above positions in the Architect's Section of the Chief Engineer's Department in Central London.

Applicants should be neat draughtsmen and preferably have had several years' experience in an Architect's office.

The post is graded under Schedule "D" of the National Joint Board Agreement as Grade 6—£535. 10s. to £661. 10s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned by 22 Jan., 1955. Please enclose addressed envelope and quote ref.: V/1785/T on envelope and all correspondence. (P 299)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

THIRD ASSISTANT ENGINEER (Control) is required in the System Operation Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 4, commencing in range £750/£875, ultimately rising to £975 per annum.

Applicants should have had a sound technical training and practical experience in connection with system control. The possession of appropriate technical qualifications and experience within a power station will be considered advantages.

Apply, quoting Vacancy No. 852MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 22 Jan., 1955. (P 365)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF ENGINEERING DRAUGHTSMAN, LEIGH

APPLICANTS must have had a good technical training and drawing office experience and should have had experience in the preparation of drawings for some or all of the following:

Switchgear layout and diagrams.
Substation layout and construction.
Overhead line design.
Preparation of wayleave and other plans.

Preference given to applicants holding the O.N.C. in Electrical Engineering and/or Building.

Salary within range £510 x £20—£630 p.a. according to qualifications and experience. Schedule D, Grade 6. N.J.B. Conditions.

NOTE.—Applicants who responded to the previous advertisement of this post need not re-apply.

APPOINTMENT OF JUNIOR ENGINEERS, SUB-AREA TESTING STATION, WALKDEN

Duties will be to test single-phase and polyphase meters of kWH RKVAH and kVA type, current transformers, voltage transformers, instruments, insulating oil and miscellaneous testing.

Qualifications up to the H.N.C. standard in Electrical Engineering and previous experience of this work is essential.

Salary Scale: £475 x £15—£520 p.a. Grade L.19. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 15 Jan., 1955.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (PLANNING AND DESIGN) SUB-AREA ENGINEER'S DEPT., OLDHAM

Applicants should have had experience in protective gear application system calculations, preparation of specifications and general technical investigations. Preference given to applicants who hold the H.N.C. (or equivalent) in Electrical Engineering.

Salary Scale: £790 x £20—£850 p.a. Grade K.10. N.J.B. Conditions.

Applications to Sub-Area Manager, The North Western Electricity Board, No. 3 Sub-Area, Union St, Oldham, by 15 Jan., 1955.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN (BUILDING AND CIVIL ENGINEERING) SUB-AREA ENGINEER'S DEPARTMENT, BLACKBURN

Applicants should have had a good general and technical education to at least O.N.C. standard in Building and Civil Engineering, and have had experience in general building construction, design and layout of industrial type buildings including site works and services.

Salary within range £510 x £20—£630 p.a. according to qualifications and experience. Schedule D, Grade 6. N.J.B. Conditions.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT ENGINEER, BLACKBURN DISTRICT

The duties will include assistance in the operation, maintenance and construction of substations and H.V. and L.V. u/g. and o/h. mains, fault location and the general maintenance of supply in the District.

Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scale: £635 x £15—£680 p.a. Grade G.11. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, ROSSENDALE DISTRICT

Duties will include control and supervision of industrial and domestic contract wiring, preparation of specifications and installation, repair and maintenance of appliances on consumers' premises. Preference given to applicants who are Associate Members of the Institution of Electrical Engineers.

Salary Scale: £715 x £15—£760 p.a. Grade E.7. N.J.B. Conditions.

NOTE.—Applicants who responded to the previous advertisement of this post need not re-apply.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, ROSSENDALE DISTRICT

Duties will include assistance in the operation, maintenance and construction of underground and overhead mains, substations and transformers, and general mains and standby duties.

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Preference given to applicants who are Corporate or Graduate Members of the Institution of Electrical Engineers, or who possess the H.N.C. in Electrical Engineering.

Salary Scale: £715 x £15—£760 p.a. Grade E.7. N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 15 Jan., 1955.

APPOINTMENT OF THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (SERVICE ENGINEER) STOCKPORT

Applicants should have had experience in the control and supervision of industrial and domestic contract wiring, including preparation of specifications and installation, repair and maintenance of appliances on consumers' premises.

Salary Scale: £675 x £15—£720 p.a. Grade F.9. N.J.B. Conditions.

Application forms can be obtained from the Sub-Area Manager, No. 7 Sub-Area, The North Western Electricity Board, Chapel St, Hazel Grove, Cheshire, and must be returned to him by 15 Jan., 1955. (P 334)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (MAINTENANCE)

OXFORD District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class G, Grade 10 (£675/£720 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the operation and maintenance of H.V. and L.V. distribution mains and substations, and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

ASSISTANT ENGINEER (PLANNING)

Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class G, Grade 12 (£595/£640 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of reinforcement to overhead and underground H.V. and L.V. networks, and will be required to undertake standby duties if necessary. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

ASSISTANT ENGINEER (PLANNING)

Newbury District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class E, Grade 9 (£635/£680 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of reinforcement to overhead and underground H.V. and L.V. networks and to undertake standby duties if required. Suitable technical qualifications and field planning experience are necessary.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

ENGINEERING DRAUGHTSMAN

Substation Section of No. 3 (Portsmouth) Sub-Area Office. Salary N.J.B. Schedule D, Grade 6 (£510/£630 per annum), commencing at a point dependent upon qualifications and experience. N.J.B. Conditions of Service.

Applicants should be qualified draughtsmen and the successful applicant will be required to undertake, under supervision, the preparation and final layout of diagrams and drawings relating to mains, substation plant and equipment and buildings.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

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JUNIOR ENGINEER

Newbury District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class E, Grade 13 (£475 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with distribution, including minor construction work, and general maintenance. Applicants should have received technical training to O.N.C. standard and have experience of similar work.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

JUNIOR ENGINEER

Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class G, Grade 15 (£475 per annum). N.J.B. Conditions of Service.

The successful applicant will be required to assist in distribution duties including minor construction work and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment, and possess suitable technical qualifications. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, in envelopes suitably endorsed, not later than 21 Jan., 1955.

The successful candidates for all the above appointments will be required to contribute to the B.E.A. and Area Board's Superannuation Scheme, if eligible. (P 368)

ATHENS PIRAEUS ELECTRICITY COMPANY LIMITED

Athens, Greece

ATHENS Piraeus Electricity Co., Ltd., has a vacancy in Athens for a really first-class young BRITISH ELECTRICAL ENGINEER (in his twenties) with sound theoretical and practical knowledge of steam power engineering. Applicants should be fully qualified, preferably with a good honours degree. They must be of the type who can command respect and friendship of able and experienced Greek engineers employed by the Company in senior executive capacities. A substantial salary can be paid to the right man. Reply to the Secretary of the Company's London agents, Whitehall Securities Corporation Ltd., 47 Parliament St, London, S.W.1. (P 287)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for a post as

STATION CHEMIST
MARCHWOOD GENERATING STATION
S/13.605

Applicants should be fully qualified industrial chemists with practical experience in fuel, oil and water testing. A knowledge of metallurgical and/or refractory problems associated with modern power plant is desirable, and a wide experience in boiler-water conditioning for high pressure steam plant is essential. Any experience in fouling problems arising from the use of oil firing and/or experience in the operation of ion-exchange water treatment plant would be an advantage.

Salary: N.J.B. Grade K7, £975 by £25—£1,050.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 19 Jan. Please quote reference E.T. (P 360)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

JOINTER E.H.T. wanted for Berwick District, Southern Sub-Area, to reside in Berwick-upon-Tweed. N.J.I.C. conditions. Present rate of pay 45d. per hour. Applications stating age, whether married or single and giving details of training and experience should reach the Board, High St, Galashiels, by 17 Jan., 1955. (P 298)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following post:
SHIFT CHARGE ENGINEER
RYE HOUSE GENERATING STATION
Salary Class G, Grade 7, £790 by £20—£850 per annum.

Applicants should preferably have served an apprenticeship and obtained a recognised qualification in Electrical or Mechanical Engineering and possess experience in the operation of a Generating Station fired with pulverised fuel.

Applications giving age and details of qualifications and experience, should be submitted to the Controller, British Electricity Authority, Eastern Division, Northmet Hse, Southgate, N.14, to arrive not later than 15 Jan., 1955.

W. N. C. CLINCH,
Controller.
(P 362)

WEST MIDLANDS GAS BOARD
Warwickshire Division
ELECTRICAL ENGINEER—
COVENTRY DISTRICT

THE position involves supervision of installation, maintenance and development of electrical plant associated with gas works processes.

As a minimum qualification candidates should hold a Higher National Certificate in Electrical Engineering and should have had experience in heavy industrial electrification including generation and distribution.

The salary will be within Grade 12 (£790/£915 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, personal details, particulars of training, experience, qualifications together with the names of two referees, should be addressed to Mr A. Allen, Divisional General Manager, West Midlands Gas Board, Warwickshire Division, Gas Offices, Gas St, Coventry, to reach him within fifteen days of the appearance of this advertisement.

J. C. INGRAM,
Secretary to the Board.
(P 337)

TRAINING OFFICER

required for the ELECTRICITY DEPARTMENT, GOLD COAST LOCAL CIVIL SERVICE for two tours of 18 to 24 months on contract. Consolidated salary scale £1,330 rising to £1,680 a year. Gratuity at the rate of £150 a year. Outfit allowance up to £60. Free passages. Liberal leave on full salary. Candidates, over 28, should have served a recognised apprenticeship in mechanical or electrical engineering and have had at least 3 years' experience in the operation of modern technical training schemes. Preference will be given to candidates holding H.N.C. in Mechanical or Electrical Engineering or O.N.C. in Mechanical and Electrical Engineering or similar qualifications. Write to the Crown Agents, 4 Millbank, London, S.W.1. Stating age, name in block letters, full qualifications and experience and quote M2A/40525/EE.
(P 347)

BRITISH ELECTRICITY AUTHORITY
North Eastern Division

APPLICATIONS are invited for the appointments of SHIFT OPERATING ENGINEERS at Stella South Power Station.

Applicants should possess a Higher National Certificate or equivalent qualifications.

The salary for these appointments (which are superannuable) will be in accordance with the National Joint Board Agreement, Schedule "A," Grade 10, Class K (£790/£850 per annum).

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne 1, to whom they should be returned to arrive not later than 17 Jan., 1955.
(P 345)

MIDLANDS ELECTRICITY BOARD
Central Gloucestershire Sub-Area

APPLICATIONS are invited for the following superannuable posts:
THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER, SEVERN VALE DISTRICT (CHIPPING SODBURY)

Duties will include development of Agricultural and other Heavy Duty Sales and Service. Experience essential. Technical qualifications desirable. Salary £595/£640 per annum (N.J.B. Grade E.10).

JUNIOR ENGINEER, SUB-AREA METER DEPARTMENT (CHELTENHAM)

Duties will include laboratory work, substandard instrument calibration, the testing of polyphase metering equipment both in the Test Room and on consumers' premises, and the carrying out of special tests on other apparatus including switchgear and relays. Technical qualifications desirable. Salary £475/£520 per annum (N.J.B. Grade H.16).

Apply, in writing, within 14 days to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 126 London Rd, Gloucester. A. Stephens, Secretary. (P 385)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for a post as
ASSISTANT SHIFT CHARGE ENGINEER—
PORTSMOUTH GENERATING STATION

Applicants should have had previous experience in a modern generating station, and manufacturing works experience will be an advantage. Preference will be given to those who either possess qualifications and experience leading to corporate membership of a recognised professional institution, or who are studying for the examinations of such an institution. The successful candidate may be required to undertake duties in either the boiler house or turbine room.

Salary N.J.B. Grade G/9. £715 x £15—£760.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 19 Jan. Please quote reference ET. MA/EMI/130. (P 305)

FOREMAN ELECTRICIAN

required for the PUBLIC WORKS DEPARTMENT, KENYA, for one tour of 40/48 months on contract. Salary scale (including present temporary allowance of 35% of salary) £742 rising to £965. Gratuity at rate of £74/£96 a year. Outfit allowance £30. Free passages for officer and wife and assistance towards cost of children's passages. Liberal leave on full salary. Candidates, not over 40, should have served a regular apprenticeship on electrical installations work and have had good subsequent experience. A knowledge of the operation and maintenance of small diesel lighting plants would be an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40581/EE. (P 346)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

SENIOR ASSISTANT ENGINEER (Electrical) is required in the Generation Construction Department at Wolverhampton. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 1, of the Agreement, commencing in range £1,100/£1,225, and ultimately rising to £1,315 per annum.

Applicants should have had wide experience in the design, construction, and installation of electrical equipment for power stations, including the preparation of schemes, specifications and estimates; also the examination of and reporting on tenders, supervision of contracts, approval of contractors' designs, and of site erection and commissioning. Applicants should be corporate members of the Institution of Electrical Engineers, and the possession of a university degree in electrical engineering will be an advantage.

Apply, quoting Vacancy No. 851MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 20 Jan., 1955. (P364)

BRITISH ELECTRICITY AUTHORITY
South Western Division

ASSISTANT ENGINEER (Technical Records) required at Plymouth "A" Generating Station.

Superannuation Scheme. Salary, N.J.B. Class "F," Grade 13, £515/£560.

Applicants should have had sound general and technical education. Preference will be given to those possessing Ordinary or Higher National Certificate.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 17 Jan., 1955. (P 366)

A LEADING ENGINEERING Organisation in S.E. Lancs requires for its commercial organisation an ENGINEER or PHYSICIST with PH.D. or 2nd Class Honours Degree. The vacancy is in a department concerned with the commercial aspects of new types of Electrical Instruments and Apparatus of Intricate Design. Some years post graduate experience essential but not necessarily in industry. Salary in accordance with age, qualifications and experience. All applications will be regarded as confidential. Write, giving full details of age, qualifications and experience, marking envelope "B.1" to—Box No. 4133, Electrical Times. (P 381)

BRITISH ELECTRICITY AUTHORITY, Headquarters, London, require a THIRD ASSISTANT ENGINEER (MECHANICAL) in the Production Inspection and Test Sub-Branch.

Candidates should preferably hold a first-class M.O.T. Certificate in steam or be Graduate Members of the I.Mech.E., or possess equivalent qualifications. The duties will be associated with the pre-commissioning mechanical inspection services on power station plant and candidates should have practical experience of inspection and testing at Manufacturers' Works, boiler and pressure vessel design, drawing office work or statutory inspection of commissioned plant.

Salary N.J.B. Grade 3 £908/£1,125 p.a. inclusive.

Applications stating age, qualifications, experience and present position and salary to Director of Establishments, Winsley St, London, W.1, by 13 Jan., 1955. Quote Ref.: ET/557. (P 354)

BRITISH ELECTRICITY AUTHORITY, Research Laboratories, Leatherhead, require a JUNIOR ENGINEER. Candidates should have H.N.C. in Mechanical Engineering or equivalent qualification. Duties include testing of fly ash concrete and other materials.

Applications to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 13 Jan., 1955. Quote Ref.: ET/535. (P 355)

JOHNSON AND PHILLIPS LTD.
Vacancies in
TRANSFORMER DEPARTMENT

1. **DESIGNER** with experience in the preparation of detailed designs for all sizes of power transformers.
2. **DRAUGHTSMEN** with experience in all sizes of power transformers up to 5,000 kVA.
3. **ESTIMATORS** with experience in the preparation of tenders for both the home and export market, and in addition, used to technical correspondence.

These positions offer good prospects with pension scheme and other facilities. Applications stating age, training, experience and salary expected should be addressed to Employment Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7. (P389p)

Insulation Engineers Required

Must have knowledge of all modern organic and inorganic insulating materials used in the electrical engineering industry. Previous experience in the application of such material to small rotating machines is essential. Practical experience in the winding of rotors and stators is desirable. This interesting work brings the successful applicant into contact with all phases of aircraft electrical engineering.

Write as fully as possible, stating your age and experience to the Personnel Dept., Rotax Limited, Chandos Road, Willesden Junction, London, N.W.10.

(P 46p)

BRITISH ELECTRICITY AUTHORITY —Production Inspection and Test Sub-Branch require two THIRD ASSISTANT ENGINEERS (MECHANICAL) in the Manchester Regional Office. Candidates should possess educational and engineering qualifications up to the standard required for Graduate Membership of the I.Mech.E. Duties are associated with production, inspection and testing of power station plant and equipment in Manufacturers' Works. Recent experience of such work and actual construction and plant erection at power stations would be considered an advantage.

Salary N.J.B. Grade 3, £865/£1,075.

Previous applicants need not reapply.

Applications stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 21 Jan., 1955. Quote ref.: ET/554. (P 315)

ELECTRICAL ENGINEERING MANAGER

required by Messrs Blackburn, Starling and Co., Ltd.,—experienced in good quality Electrical Contracting work—and must be able to prepare schemes and estimates, submit tenders and supervise the works—must be able to render first-class services to customers. Men able and willing to work without immediate supervision having energy, enthusiasm and are keen to make progress, who possess the qualities of tact, diplomacy, honesty, high integrity and having good presence and manners please apply before the 18th Jan., 1955, to:

The Managing Director,
MESSRS BLACKBURN, STARLING AND CO., LTD.,
Gresham Works, London Rd, Nottingham.

(P 375p)

BRITISH ELECTRICITY AUTHORITY, Headquarters, London, require a THIRD ASSISTANT ENGINEER to carry out duties in connection with the inspection of all types of electrical plant and equipment for power stations.

Candidates should have qualifications equivalent to Grade I.E.E., and have had recent experience of inspection of electrical plant and equipment in Manufacturers' Works.

Salary N.J.B. Grade 3, £908/£1,125 p.a. inclusive.

Applications stating age, qualifications, experience and present position and salary to Director of Establishments, Winsley St, London, W.1, by 12 Jan., 1955. Quote ref.: ET/552. (P 314)

BRITISH INSULATED CALLENDER'S CABLES LTD. have a vacancy with their telecommunications Laboratory at Kirkby for an HONOURS GRADUATE in Physics or Electrical Engineering to take charge of a small but growing team engaged on the design of accessories for audio carrier and V.H.F. cables and the development of pneumatic protection for underground cables. Applications quoting reference P/58/54 should be submitted to: The Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (P 377)

BRITISH ELECTRICITY AUTHORITY, Headquarters, Bankside, London, have vacancies for:

(*a*) SENIOR CIVIL ENGINEERING DRAUGHTSMAN (Grade 5).

(*b*) CIVIL ENGINEERING DRAUGHTSMAN (Grade 6).

(*c*) ELECTRICAL DRAUGHTSMAN (Grade 6).

Starting salaries according to qualifications and experience:

Grade 5—£672/£777 per annum inclusive.

Grade 6—£536/£662 per annum inclusive.

Pension Scheme. One Saturday morning in four on duty. Application forms from Director of Establishments, B.E.A., Winsley St, London, W.1. Quote ref.: ET/558. (P 379)

BRITISH ELECTRICITY AUTHORITY, Headquarters, London, require a SECOND ASSISTANT ENGINEER (Electrical) in the Specifications and Contracts Branch.

Candidates should preferably be Associate Members of the I.E.E. or possess equivalent qualifications and will be expected to have a knowledge of all aspects of specification and contracts work in connection with electrical equipment for Power Stations, including analysis of tenders and preparation of recommendations for the placing of contracts.

Salary N.J.B. Grade 2, £971/£1,325 per annum inclusive.

Applications stating age, qualifications, experience and present position and salary to Director of Establishments, Winsley St, London, W.1, by 13 Jan., 1955. Quote Ref. E.T./553. (P 318)

AIRCRAFT ELECTRICAL ENGINEERING

Applications are invited for pensionable appointments on the Senior Staff of the Design Office. Applicants should be well qualified men with the experience and designing ability to justify the payment of good commencing salaries. Please write fully, stating salary expected, in first instance, to The Personnel Supervisor.

HAWKER AIRCRAFT LIMITED,
Canbury Park Rd,
Kingston-on-Thames, Surrey.

(P 374p)

ASSISTANT ELECTRICAL ENGINEER

Assistant Electrical Engineer required for expanding continuous process plant. Minimum qualifications H.N.C. Preference will be given to Candidates who have some experience of the following: Generation and distribution, frequency changers, fractional h.p. motors, corrosion and flame-proof gear in chemical processes, illumination design and installation. Supervisory experience essential. Good salary and prospects. Pension scheme. Age 27 to 45 years. Applications, which will be treated in confidence, should state age, qualifications and details of previous experience and be addressed to Personnel Manager:

BRITISH ENKA LTD.,
Aintree, Liverpool, 9.

(P 322p)

BRITISH ELECTRICITY AUTHORITY, Derby Sub-Regional Office, Production Inspection and Test Sub-Branch require a SECOND ASSISTANT ENGINEER.

Candidates should preferably be Associate Members of the I.Mech.E. or possess equivalent qualifications and have had recent experience of production, inspection and testing of power station plant and equipment in Manufacturers' Works.

Salary N.J.B. Grade 2, £925/£1,275 p.a.

Applications stating age, qualifications, experience and present position and salary to Director of Establishments, British Electricity Authority, Winsley St, London, W.1, by 19 Jan., 1955. Quote Ref.: ET/555. (P 352)

BRITISH ELECTRICITY AUTHORITY, Leeds Regional Office, Production Inspection and Test Sub-Branch, require a THIRD ASSISTANT ENGINEER (MECHANICAL).

Candidates should have qualifications up to the standard required for Graduate Membership of the I.Mech.E. The duties will be associated with the production, inspection and testing of Power Station plant and equipment in Manufacturers' Works and recent experience of such work and actual construction and plant erection at Power Stations would be an advantage.

Salary N.J.B. Grade 3, £865/£1,075 p.a.

Applications stating age, qualifications, experience and present position and salary to Director of Establishments, British Electricity Authority, Winsley St, London, W.1, by 13 Jan., 1955. Quote Ref.: ET/556. (P 353)

ENGLISH ELECTRIC CO., LTD.,

Stafford,

have vacancies in their

INSTRUMENT DIVISION

for

SALES AND CONTRACTS ENGINEERS

preferably with H.N.C. or O.N.C. and some experience in this field. Good prospects of future outside representation. The positions offered are permanent, progressive and pensionable. Reply in confidence, and quoting Ref. 1175F, to

Dept. C.P.S.,
336/7 Strand, W.C.2.

(P 323p)

CABLE ESTIMATOR required. Age about 25 years, with experience in cable design and works estimates. Central London Area. Please send full details to—Box No. 4109, Electrical Times. (P 256)

CONTRACTS ENGINEERS. A. Reyrolle and Co., Ltd., have a number of vacancies for Contracts Engineers at Hebburn, Co. Durham. The Engineers are required for work in connection with extra high voltage, high voltage and medium voltage switchgear and protective gear contracts for both Home and Overseas work. The work is interesting and varied and requires both technical and commercial ability. On Overseas contracts there is also the possibility that the engineers may be ultimately considered for appointments abroad. Applications will be considered from Graduates or Corporate Members of the Institution of Electrical Engineers or from Engineers holding Higher National or Ordinary National Certificate.

Applications should be forwarded to the Contracts Manager, A. Reyrolle and Co., Ltd., Hebburn, Co. Durham, marked "Personal." (P 316)

DESIGN ENGINEER required with experience in Rectifiers, Motor Drives and Magnetic Controls. Good salary and pension. Apply with details of training, experience, etc., to Nevelin Electric Co., Ltd., Purley Way, Croydon, Surrey. (P 319)

DESIGN ENGINEER required to take charge of a section located in Central London Area, producing designs for domestic and light industrial wiring accessories, fuse gear, automatic cut-outs, etc. Must be progressive and able to produce original ideas for new lines, and improvements to existing lines. Knowledge of manufacturing processes associated with this class of apparatus is essential. This is a progressive position with one of the most substantial and oldest established Companies in this business, offering security and the advantage of a pension scheme. Write stating age, qualifications and experience.—Box No. 4137, Electrical Times. (P 391)

DRAUGHTSMEN-DESIGNERS wanted to work in Central London Area on designs for domestic and light industrial wiring accessories. Previous experience desirable on light current switch, fuse and automatic control gear. This is an opportunity to join a substantial old established Company offering security, a good salary to competent men, and a pension scheme. State age, qualifications and experience to The Secretary, The Edison Swan Electric Co., Ltd., 155 Charing Cross Rd, London, W.C.2. (P 390)

DRAUGHTSMAN required (Victoria Area) for Manufacture of L.T. Switchgear and General Engineering. Prospects for man with initiative. Write age, experience and salary required.—Box No. 4139, Electrical Times. (P 392)

DRAUGHTSMEN, detail, age 25 years or over. Experienced in detailing Switchgear Panels an advantage. Apply Personnel Manager, Simplex Electric Co., Ltd., Broadwell Works, Oldbury, Birmingham. (P 387)

ELECTRICAL CONTRACTORS, known nationally, invite applications for post of Manager for London Office. Commencing salary £1,500 per annum with exceptional opportunities of promotion. Generous superannuation. Good business connections essential. Apply stating age, training, experience and qualifications to—Box No. 4117, Electrical Times. (P 324)

ESTIMATORS for Indoor Sales Staff required by Crompton Parkinson Ltd., Chelmsford. Applicants must have initiative and be experienced in dealing with enquiries relating to A.C. and D.C. rotating electrical machinery up to 1,500 h.p. /kW. Superannuation scheme, and extensive social, sports and welfare facilities. Write giving fullest particulars, to the Personnel Officer. (P 280)

FOREMAN ELECTRICIANS

TWO FOREMAN ELECTRICIANS required for service with the SUDAN LIGHT AND POWER CO., LTD., in KHARTOUM, SUDAN, as Supervisors to plan and control the activities of a number of site foremen engaged on electrical installation work in buildings and to train Sudanese personnel. Applicants must be of good general education and have served at least 5 years' Indentured Apprenticeship with a reputable firm of Electrical Engineers or Contractors. They must have a thorough knowledge of Power and Lighting installations work and be fully experienced in the use of heavy gauge conduit and pyrotenax. Salary in range £E.804 to £E.1,284, according to qualifications and experience. (£E.1=£1. 0s. 6d.)

Appointments will be on contract for a period up to 5 years, including a period of 12 months' probation, with a bonus payable on completion of the Contractual period. A Cost of Living Allowance will be payable in addition to salary. A Kit Allowance of £E.50 will be payable on appointment. Free living accommodation with basic furniture or an allowance in lieu thereof and free transport will be provided. After satisfactory completion of the probationary period liberal leave on full salary with free passages.

Applications stating age, education, qualifications, experience with particulars of posts held, present appointment and salary with names of two referees should be submitted to the Secretary, the Power and Traction Finance Co., Ltd., Queen's Hse, Kingsway, London, W.C.2. (P 306p)

ELECTRICAL ENGINEER, age 25 to 30, preferably graduate with light current experience required at our Weybridge Office for detail engineering and contract work on E.H.T. transmission equipment and control. Apply Kennedy and Donkin (Ref.: MVR), 12 Caxton St, London, S.W.1. (P 339)

ELECTRICAL ENGINEERS, to O.N.C. H.N.C. standard, for staff of Engineering Department of control gear factory. Experience of control circuits an advantage. Apply in writing to Mr Thomson, the Belmos Co., Ltd., Scottish Industrial Estate, High Blantyre, Lanarkshire. (P 373)

ELECTRICAL SUPERINTENDENT wanted by Canadian-owned public utility in Georgetown, British Guiana. Age around 30, married or single, H.N.C. grade. Salary 550 B.W.I. dollars per month (4.80 to £1). Permanent position, excellent prospects; apply for fuller particulars with outline education, training and experience to —Box No. 4131, Electrical Times. (P 380)

ELECTRIC MOTOR DESIGNER

We have a vacancy on our Staff for a man with sound practical experience in the Electrical Design of D.C. Motors and Generators, 1—200 h.p. Preference will be given to applicants having A.C. experience.

Pension Scheme, 5-day week, and housing facilities available.

Reply in confidence, stating age, experience and Salary expected.

Hugh J. Scott and Co. (Belfast) Ltd.,
Volt Works, Ravenhill Rd, Belfast.

(P 311p)

ENGLISH ELECTRIC CO., LTD., at Stafford invite applications from ELECTRICAL ENGINEERS, having a minimum technical qualification of H.N.C., for a position in a section preparing schemes for and dealing generally with the application of control gear to many types of steelworks and similar drives. The position offers excellent opportunities to a capable engineer. Previous experience in this field is preferred, but not essential. The commencing salary being offered is in the range of £550/£700. Apply with full personal details and quoting ref. No. 769D, to Dept. C.P.S., 336/7 Strand, W.C.2. (P 397)

ENGINEER, aged 25/35, with electrical or physicist degree required by Cable Company in London Area for development work on testing equipment for telecommunication cables. Permanent and pensionable position at salary commensurate with experience and qualifications. Apply giving full particulars to—Box No. 4143, Electrical Times. (P 394)

ENGINEER, aged 22/35, required by Cable Company in London Area for testing and maintenance of electronic equipment in new instruments for automatic testing of telecommunication cables. Apply giving full particulars to—Box No. 4141, Electrical Times. (P 393)

HIGHLY QUALIFIED ASSISTANT to Managing Director required for Transformer Manufacturing Company in North Country. Applicants must have first-class knowledge of Transformer design and manufacture, and preferably commercial knowledge. Duties: Management Control and Technical Advisory, therefore applications from men of mature age up to 52 will receive favourable consideration. Salary according to age and experience, but £2,000 plus Profit-sharing Bonus Scheme indicated. Contributory pension plan with free life Assurance benefits. Housing assistance given. Apply to—Box No. 4123, Electrical Times. (P 327)

GENERAL REPRESENTATIVE with ability required by a leading electrical engineering company for the County of Hertfordshire.

Write with full details of age, experience, qualifications and salary required to—Box No. 8237, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (P 317)

IMPERIAL CHEMICAL INDUSTRIES LTD., Plastics Division, has an immediate vacancy for an ELECTRICAL DRAUGHTSMAN in the Chief Engineer's Department at Welwyn Garden City. Candidates must have served a recognised apprenticeship and should hold the Ordinary National Certificate. Experience of factory and general industrial installation work would be useful.

An attractive starting salary will be offered to the selected applicant beyond which there is plenty of scope for progression to a good salary ceiling at a relatively early age. The appointment is permanent and carries membership of the Staff Pension Fund.

Apply giving full particulars to the Staff Manager, I.C.I. Ltd., Plastics Division, Black Fan Rd, Welwyn Garden City, Herts. (P 310)

INSTRUMENT SALES ENGINEER.—A well-known electrical company require a first-class man to be responsible for the development of the sales of a variety of electrical instruments throughout the British Isles. The appointment will be based on London and preference will be given to candidates aged 25-35 with a sound technical knowledge of electrical instruments and their uses. Applications giving details of qualifications and experience should be sent to the Staff Manager—Box No. 4119, Electrical Times. (P 325)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

ENGLISH ELECTRIC

is expanding its activities in the Middle East and is seeking to recruit TECHNICAL SALES ENGINEERS to join Engineering Agencies particularly in:

Ethiopia based on Addis Ababa.
Iran based on Teheran.
Iraq based on Baghdad.

Applications are invited from candidates who have served an apprenticeship in either electrical or mechanical engineering, and have had experience of similar work preferably in the Middle East. Single men are preferred but married candidates will be considered.

Please apply giving full personal particulars to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 933H and including territory in which interested. (P 312p)

INDUSTRIAL HEATING ENGINEERS are required in London by a large electrical firm to promote the sales of space heating and other I.H. equipment. Candidates should have the Higher National Certificate or equivalent and some works experience coupled with a good personality and enthusiasm for sales work. Applications should be addressed to the Staff Manager—Box No. 4121, Electrical Times, giving details of age and experience. (P 326)

OLD-ESTABLISHED Electrical Contractors, Westminster, have vacancies for ESTIMATING and SUPERVISING ELECTRICAL ENGINEERS. Experienced men preferred, but would consider up-grading and training capable experienced Foremen. Please submit details of age, experience, salary expected, etc.—Box No. 4129, Electrical Times. (P 341)

ELECTRICAL DESIGNERS

Are you experienced in the design of generating and electrical distribution systems?

We require men with Higher National Certificate, or equivalent, for interesting work in the designs section of our laboratories which specialise in aircraft electrical generating systems and equipment. Additional experience in aircraft wiring and distribution an advantage but not essential. This interesting work brings the successful applicants into contact with all phases of aircraft electrical engineering.

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PROGRESSIVE Electrical Wholesalers require the services of an experienced STOREKEEPER. Apply, Electrowares Ltd., 302 Waterloo Rd, S.E.1. Telephone Waterloo 5271. (P 378)

PILKINGTON BROTHERS LIMITED, who are the largest manufacturers of plate and sheet glass in the British Commonwealth and employ more than 20,000 persons wish to appoint a HEAD of their TECHNICAL DEVELOPMENT DEPARTMENT. This is a new appointment necessitated by the large number of development projects in hand. It is intended that the man selected should take charge of the development of new processes and the radical improvement of existing ones. There are ample technical resources available and the Company spends large amounts on development work. Applicants must have a good Honours Degree in engineering, physics or chemistry. They must also have a flair for development work, and the enthusiasm to see a job through. Applications will be welcomed from men aged preferably 35/45 who have done at least 5 years' development work in industry or at a University. The Company is prepared to offer a Service Agreement on an attractive salary to the right man. The Company operates contributory Superannuation and Widows Pension Funds. All applications will be treated confidentially and should be addressed to the Chief Personnel Officer, Pilkington Brothers Limited, The Glass Works, St. Helens, Lancashire. (P 309)

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THE GENERAL ELECTRIC CO., LTD., have vacancies for TELEVISION SERVICE ENGINEERS at their Service Depot in Westminster. Excellent opportunities exist for those having had previous experience. The positions are pensionable and the Depot operates a 5-day week. Apply in writing, quoting Ref. S.D. to the Staff Manager, Magnet House, Kingsway, W.C.2. (P 332)

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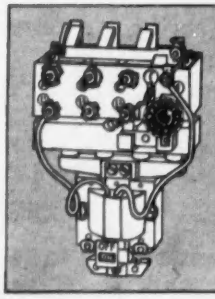		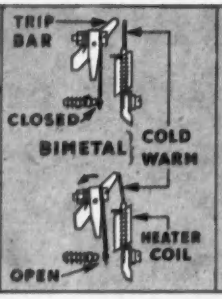	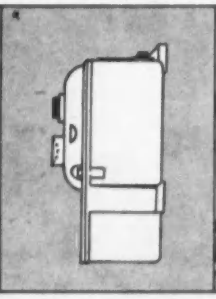	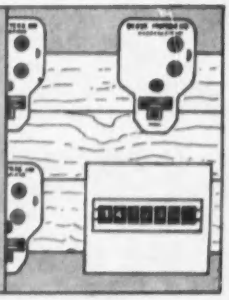
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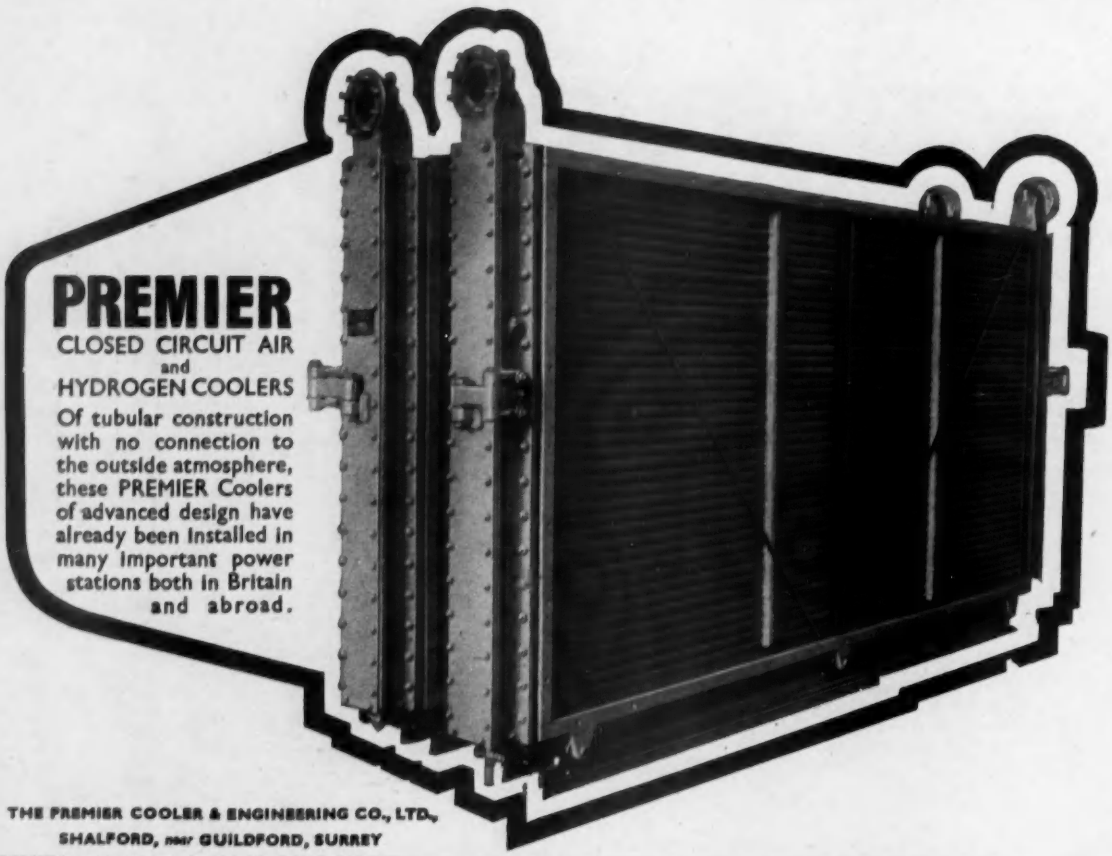

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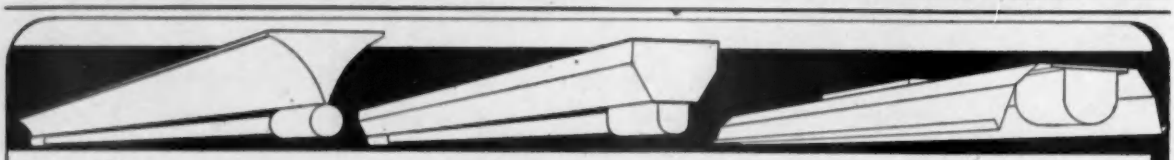

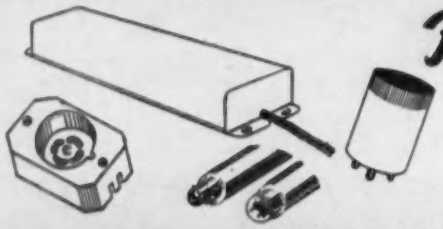

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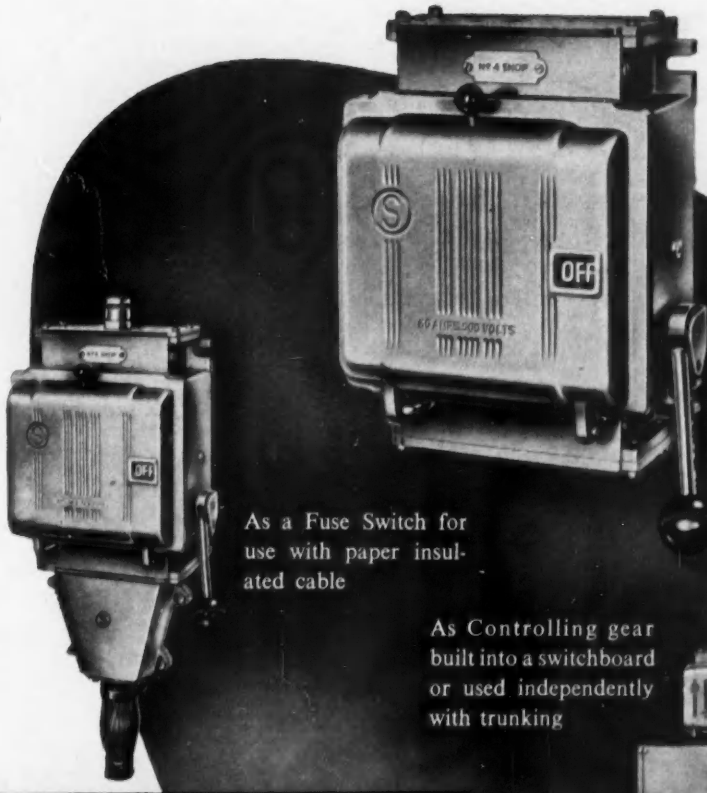

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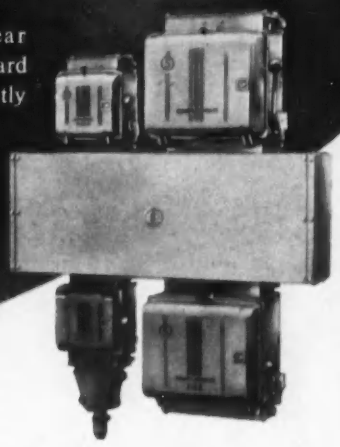

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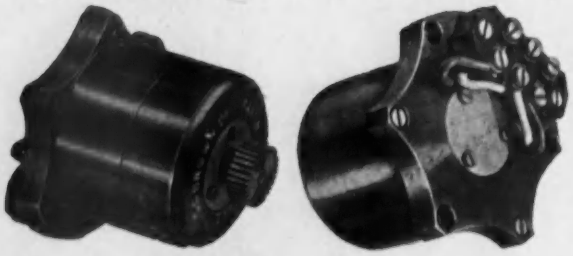

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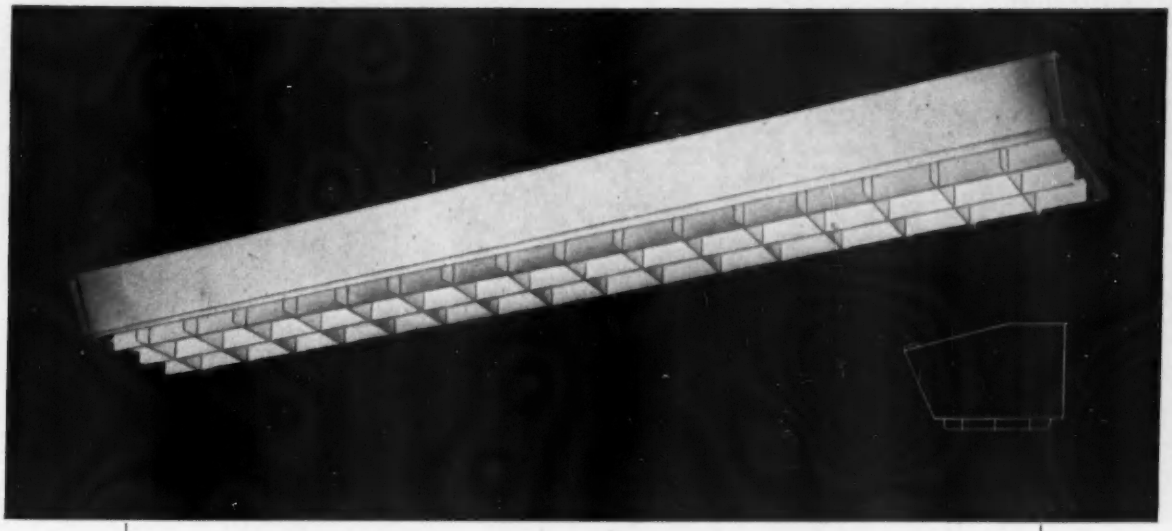

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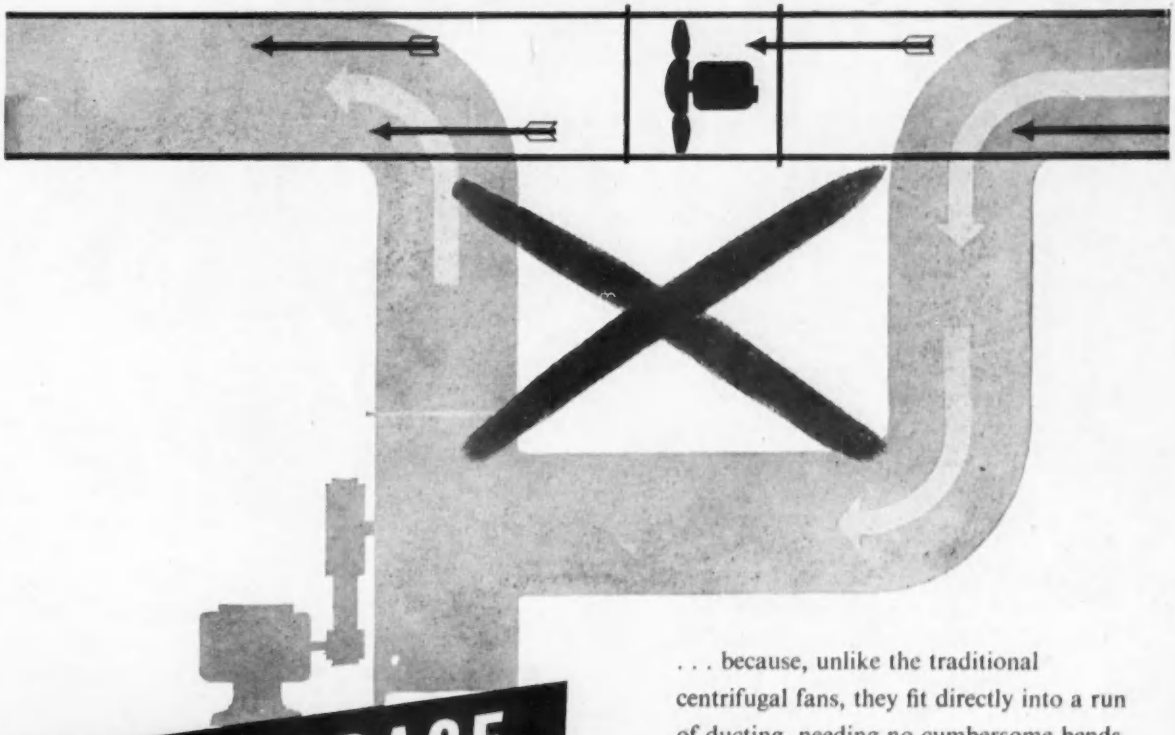

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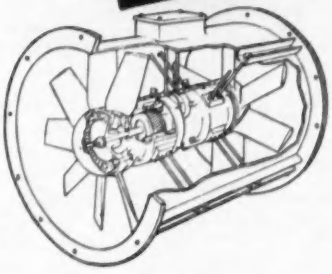

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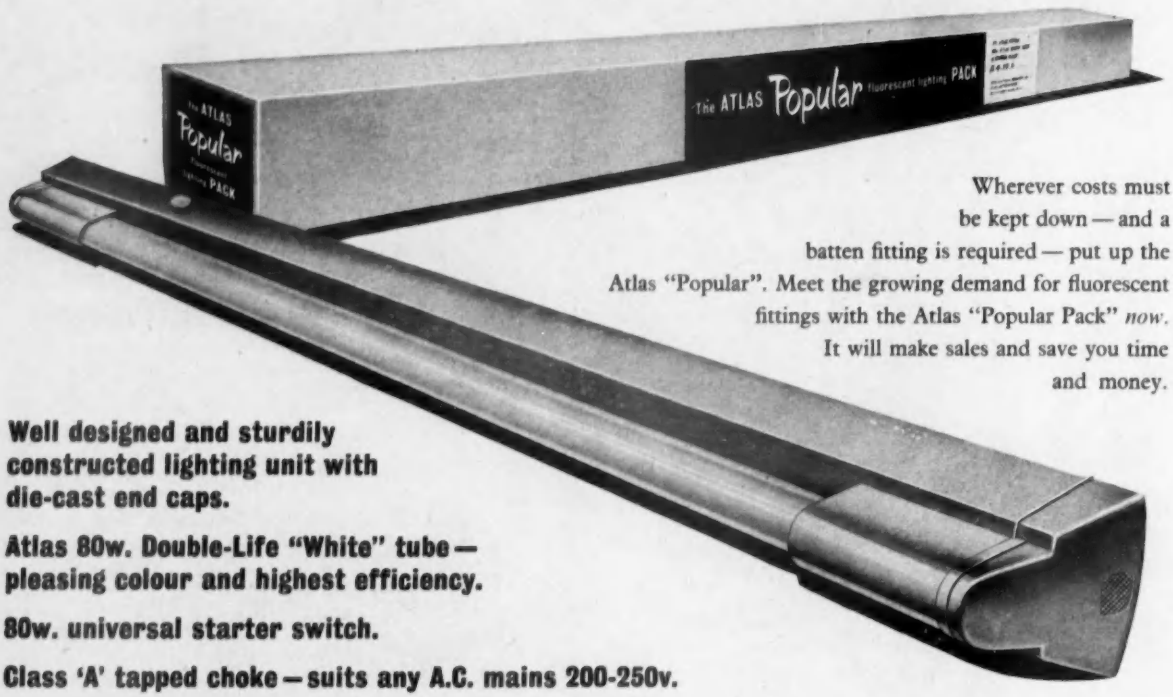

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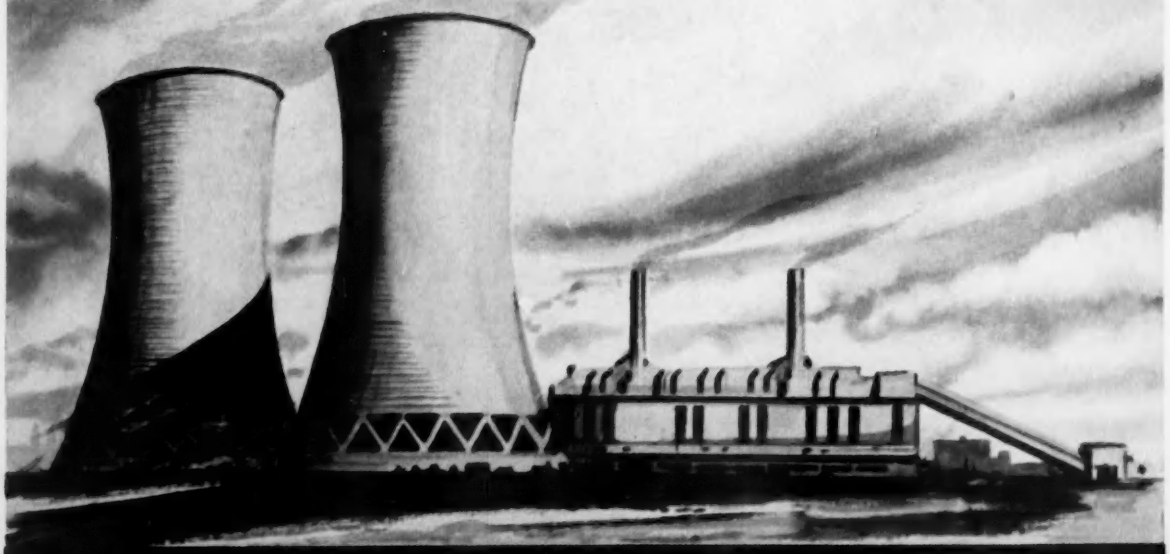

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